The Valuation Mirage

Chapter 2

Financial Modeling

Practical Development of Cash Flow Forecasts for Valuation

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Financial Modeling:
Practical Development of Cash Flow Forecasts

Introduction

One of the inevitable steps in any valuation analysis is making some kind of projection of certain financial statistics. The projections you make may develop forecasts of earnings per share, dividends or capital gains from the purchase of shares of stocks; cash flows to equity and debt holders from investment in a project finance venture; cash flows and earnings that result from acquisition of an entire corporation or other numbers. In most business applications, making the cash flow projections requires some kind of financial model. A well structured financial model, the subject of this chapter, facilitates realistic and effective risk assessment (chapter 3) as well as the application of different valuation techniques (chapters 4 and 5). To many people, mechanical issues addressed in this chapter that deal with how to structure, build and evaluate deterministic financial models (that is, models which do not incorporate probability distributions) are far more mundane topics than issues such as developing Monte Carlo simulation, valuing real options, estimating debt capacity and making forward price projections discussed in subsequent chapters. If your primarily interest is in these theoretical valuation issues or if you already consider yourself to be proficient in building models, this chapter can be skipped without affecting understanding of the subsequent chapters. On the other hand, if you have not developed models or even if you are an experienced model-builder who would like see some novel modeling ideas, the techniques described in this chapter can hopefully make your life easier.

One of the most influential and lasting ideas in finance has been the work of Modigliani and Miller in 1958 who demonstrated that the focus of valuation should be on free cash flow that can be distributed to debt, equity any other investors rather than the way the cash flow is split up between alternative investors (chapter 4). If you really still believe the theory developed by Modigliani and Miller that financing does not make any difference in the way real world investments are made, you should then stop financial models after computing operating cash flow (EBITDA) capital expenditures, working capital changes and taxes on operating earnings (EBIT). These are the components of the typical definition of free cash flow, namely operating cash flow less taxes that must be paid before money goes to investors; less capital expenditures that must be made to sustain operations and less working capital changes. Although calculating prices, demand, cost structure and the cost of capital equipment – the drivers of free cash flow -- is the most important aspect of any model, almost all of the valuation techniques described later in the book require analysis of earnings after interest and/or debt and equity cash flows after debt service and/or financial ratios that include balance sheet items. Therefore, much of the discussion of financial models in this chapter considers the financial structure of the company and the distribution of free cash flow to debt investors, equity investors and income taxes.

After the financial crisis that was in large part caused by the undisciplined and often fraudulent sub-prime lending practices along with the associated structured finance products such as collateralized debt obligations, many suggested that complicated investments are simply too difficult and opaque for investors to understand and model. Investment bankers had supposedly created dangerous overly-complex products that could not be analyzed and should have been tightly regulated. To model the value of these structured investments (so named because they split-up or structure operating cash flows to different investors) financial models had to be created that not only measure operating cash flow, but who gets the cash flow in what order in alternative states of the world. Modeling of CDO's is famous for being "confusedly elegant" and relying on complex statistics that are all but impossible to interpret. The outputs of fancy statistical analysis was sold as really representing economic behavior and sophisticated models that measured value at risk and the probability of default gave people a false sense of comfort that they could take risks which in hindsight turned out to be silly. By working through the financial modeling mechanics in this chapter, you should see that valuation errors made because models or studies are

incomprehensible are no excuse for poor risk assessment. Building a financial analysis were one sees who receives cash flow in what order and then performs risk analysis even for a toxic collateralized debt obligation is not difficult if you are careful with the structure of the model. Finally, even if you are an "excel phoebe" you should be able to understand financial models and make informed decisions about the risk of a security. Financial modelling is not very complex or mysterious even though financial modelers sometimes seem to be involved in a conspiracy that makes the analysis impossible to understand.

Probably the only real way to learn financial modeling is working late at night with a tight deadline under the pressure of a transaction. Real modeling is not a linear process, but involves gathering information, focusing on data that is relevant and coming up with ways to best represent the business. The process of developing revenue and capacity is generally the most time consuming and important part of the model that requires a lot of time and creative thought. Notwithstanding this, outlining the structure of models and presenting real world examples in this chapter is intended to provide a head start for those who have not build models and will have to learn the hard way. Further, some of the concepts presented below can be helpful even to experienced model builders in designing and structuring more efficient, stable, transparent and accurate models. The chapter provides practical instructions on how to build a well structured financial model that clearly delineates inputs, effectively presents key value drivers, uses separate modules to organize various components in a logical manner, accurately computes cash flow that is available to different debt and equity investors, and presents results of the analysis that effectively represents risks of the investment. Unlike other chapters where statistical, economic and financial theory provides the basis for making forecasts and assessing risk, the modeling issues discussed here can generally be explained using a cook-book style step by step approach. A bit of theoretical discussion of how different types of models can be used to establish value is included, but the main objective of this chapter is simply to provide details on how to build better models. In discussing the process for building an efficient financial model, this chapter is organized into the following sections which correspond to general structure of a financial model:

- Model objectives and the general notion of keeping models simple
- Structure and layout of alternative types of models
- Avoiding bad programming practices
- Organizing time periods in a model
- Projecting revenues, expenses and capital expenditures in a working analysis
- Programming the debt schedule with alternative loan structures
- Developing fixed asset modules with depreciation and amortization
- Creating the income statement and tax schedule
- Establishing the cash flow statement and a cash flow waterfall
- Generating a balance sheet and other auditing tools
- Presenting key valuation outputs of a model
- Computing the value of investments from cash flow forecasts in alternative models

In addition to these subjects, the chapter includes four appendices that address specialized topics. The first appendix reviews the idea of valuing an investment from free cash flow and the weighted average cost of capital. The second appendix addresses terminal value calculations that are an important issue in corporate models. The third appends describes how to adjust project finance models to model real estate projects. The final appendix addresses modelling issues that arise in valuing financial institutions.

Some of the subjects discussed in this chapter such as organizing time periods of the model, using techniques to verify the accuracy of mechanical calculations and computing tax depreciation are not very glamorous. While these topics may not have dramatic effects on valuation, use of good modeling practice can improve the efficiency of the process and allow you to spend more time on the important issue of risk analysis (chapter 3). Moreover, there are many practitioners who have created models the wrong way for a long time who can attest that a few simple ideas regarding structuring and programming models can dramatically improve the operation of a model and ultimately improve valuation analysis.

In addition to describing the idea behind various modeling concepts, each section of this chapter includes a few practical programming tips that that can make financial models more efficient. Further, a set of model building exercises are included on the CD that address each modeling issue if you would like to practice. The exercises are designed so that you can work through each of the modeling techniques and be able to master the programming approaches when applying them to any financial model. Finally, complete template models are also included on the CD so that you can see what a completed model may look line and steal some modeling ideas.

Model Objectives, Model Types and Keeping Models Simple

As emphasized in the case studies of valuation mistakes from the first chapter, effective risk assessment is the centerpiece of valuation. Depending on the valuation approach, risk assessments address risks to equity holders, risks to senior debt providers or risks to other parties such as contract counterparties. The central idea in building a model of future cash flows is to assess risks in a transaction, whether the transaction is simply purchasing a stock, borrowing money, investing in an airport, acquiring a company or signing a contract. Assessing risks can mean evaluating to what extent a particular covenant reduces risk of default to determining how demand growth affects cash flow. In one way or another, finance boils down to gauging risks against expected returns.

Some seemingly complicated modelling techniques are presented in this chapter, but the most important modeling ideas involve relatively simple techniques. Despite working through a few somewhat complex modelling issues such as cash flow waterfalls, accelerated depreciation, debt defaults, tax loss carryforwards and resolving circularity associated with debt service reserves and capitalized interest, sculpting debt, it is generally a good recommendation to keep the models as simple as possible. Instead of worrying obsessively about small details in a model, it is generally better to concentrate on assuring that risks of key variables are effectively presented alongside the value statistics. After the financial crisis, there has be a movement back to fundamentals and creation of simple models which assure that the most important variables do not get lost in overly complex models and transactions. For example according to an article in the Financial Times, Moody's complex financial models for evaluating a certain type of CDP, a CPDO, contained a bug had a big impact on ratings[1]:

> *A single small error in the computer coding that Moody's used to run its CPDO performance simulation had thrown the results way off. When the error was corrected, the likelihood of CPDO default increased significantly. CPDOs, it turned out, weren't triple-A products at all. Preliminary results suggested the error could have increased the rating by as many as four notches.*

Instead of creating models that are overly complex, when one is evaluating the risk of subordinated debt in a structured finance transaction, a simple but effective way to present risk is to see how low or high a variable can move before defaults occur – the break-even point (Chapter 3). Once the break-even point is known, then the focus of the analysis can be on the possibility that the variable can reach such a pessimistic level. Much more complex modelling with Monte Carlo simulation with sophisticated analysis of probability distributions may not be nearly as useful in evaluating the investment decision as this simple break even analysis. Models should not become impossible to understand large black-boxes with thirty different spreadsheets as illustrated by the quote below.[2]

> *Our experience in the financial arena has taught us to be very humble in applying mathematics to markets, and to be extremely wary of ambitious theories, which are in the end trying to model human behavior. We like simplicity, but we like to remember that it is our models that are simple, not the world.*

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[1] FT: When junk was gold (rating agencies and sub-prime), By Sam Jones. Illustrations by Balint Zsako, Financial Times, Published: October 17 2008.

[2] Emanuel Derman Paul Wilmott, January 7 2009 "The Financial Modelers' Manifesto"

In order to manage the discussion of different financial modeling issues, financial models are broadly categorized into three different types – deterministic models, stochastic models and back of the envelop models. Deterministic and stochastic models receive the most attention in discussion of valuation, but the third type, the back of envelope models should be part of the process:

Deterministic Models: Deterministic models are the kind of models most of us are familiar with. Even with all of the methods presented below to make the models transparent and logically structured, these deterministic models can become large and difficult to audit. Risk analysis in deterministic models is generally computed using judgmental assessments about how selected variables can change relative to base case assumptions. For example in valuing a hotel, one would develop projections of the room price per night, the occupancy rate, operating expenses and so forth to compute projected cash flow and value.

Stochastic Models: Stochastic models build on deterministic models but include probability distributions around key variables. The probability distributions depend on relatively sophisticated mathematical analysis of economic variables and their correlation with one another. (Chapter 3) After the stochastic variables are added to a financial model, one can compute probability distributions associated with key valuation measures such as rate of return or probability of default. For example in analyzing a hotel, one could assess the probability distribution of future occupancy rates and convert those to a distribution of rates of return.

Back of the Envelope: Simple back of the envelope models can be more important than the other two model types. These models may involve developing some kind of metric to check whether the complex model results are reasonable or they may involve simple statistical checks of the valuation. For example, in valuing a hotel one could calculate the value per room and assure it is reasonable relative to the costs of other similar hotels. Alternatively you may compute the return on investment on a year by year basis and think about whether it is really possible to earn the returns given the competitive structure of the industry. Coming up with effective ways to independently check a model can require more creativity and be more difficult than the other models.

The description of modeling methods in this chapter and the next address the first two model types: deterministic models and stochastic models without discussing the third type. This does not mean that back of the envelope models should be considered less essential in the valuation process. In fact, developing simple models (which is not synonymous with easy models) may be more important than any of the other analyses. Proving a valuation concept with a relatively simple analysis should if possible be the beginning of the analysis as well as the end of the analysis. One actual example with not making a back of the envelop analysis is demonstrated by a case where various different companies were asked to bid for the purchase of exiting electricity plants. The electricity plants were sold by a company named Central Main Power Company ("CMP") and the company that "won" the bid was named FPL Energy for $886 million. The plants being sold were old and consisted of 1,185 MW; the largest plant in the portfolio was an oil fired plant in the U.S. State of Maine named the Wyman plant (594 MW) which had entered service about twenty years earlier.

When selling the plants, CMP used an auction process which of course came along with a strict deadline for submitting bids. FPL was able to buy the Wyman Plant and others by making a bid that was higher than the bids submitted by other companies and it is safe to say the FPL experienced a case of buyers curse. FPL most probably used very sophisticated projections of future electricity prices, transmission constraints, and natural gas prices along with a big deterministic financial model in coming up with its bid. As is common in this sort of analysis, the modeling was likely finalized late at night and everyone was probably very tired. In the end, the FPL bid for the old oil plant and the other used plants of $748/kW was

a lot more than the cost of new and much more efficient natural gas combined cycle plants which were being constructed at a cost of less than $600/kW.[3] According to rumor, FPL's sophisticated models contained errors that resulted in the high valuation. A back of the envelope analysis would have developed an approximate valuation by discounting the cost of a new plant to consider age and efficiency factors. Little more than a year after the purchase, FPL took a $176 million write-off as a result of paying too much for the CMP assets.[4] In this situation, a much simpler model that adjusted the cost of a new plant for the age and other factors would have been an important check of the sophisticated deterministic or stochastic models.

Model Layout for Alternative Types of Valuation Analysis

Before beginning to enter data developing any formulas or making valuations, you should think about the architecture of a model. The structure of any analysis involves laying out the inputs, constructing mathematical calculations and presenting outputs. When pondering the general design of a financial model, one must decide how to organize the inputs from various information sources in an organized manner; how to formulate the mechanical calculations in a transparent manner that is easy to audit; and, finally how to present the outputs so that purposes of risk assessment and valuation. Other than thinking about the inputs, calculations and outputs of a model, subjects that should be considered in structuring the model are the programming of time periods, the methods for verifying model accuracy and the setting-up of alternative scenarios. One of the most essential elements of constructing an effective model is simply putting things in an order that makes sense and understanding the starting point of the model.

The layout and ordering of items in a financial model to a large extent depends on the type of investment being assessed. Most financial models can be classified into four general categories -- corporate models, project finance models, acquisition models and merger integration models. Because of different data sources and alternative valuation techniques, the layout of financial models is different for each of these model types. In addition to the four general models, specialized models can be constructed for real estate development projects as well as for banks and other financial institutions. Many issues associated with real estate and financial institution models are covered in describing the four general model categories. For example, the real estate models where properties are assumed to be sold at multiples called cap rates have elements of project finance models in which new projects are constructed as well as acquisition models where holding periods are assumed. However there are some unique issues associated with the models including structuring portfolios of real estate projects where each project has different start dates and programming maintenance of adequate capital ratios for bank models. These specialized issues are discussed in Appendix 2.

The four model types have different objectives and a different structure. The valuation techniques, data sources and outputs of these models can be summarized as follows:

Corporate Model: The distinguishing feature of the first and most common model type, a corporate model, is that a corporation has a history and it is assumed to last indefinitely (although virtually all will either end up in bankruptcy or eventually be purchased.) This means that valuation of a corporation begins with historic analysis and the models must include some kind of terminal value assumption. The terminal value calculation is necessary because it is not reasonable to make detailed forecasts of cash flow item for the indefinite life of the corporation which would require forecasts for fifteen to fifty years into the future. An important item in corporate models is the projection of earnings per share since this is the number evaluated by investment analysts.

[3] 2001 FPL SEC 10-K.
[4] 2001 FPL SEC 10-K, the official reason given by FPL for the write-off was a change in regulations regarding transmission pricing.

Project Finance Model: The second type of model, a project finance model, differs from a standard corporate model because the investment is characterized by different phases with different risks; the fact that no history on cash flows exists for the investment (no matter how many times a similar new combined cycle plant is built, you don't know how it will work until you switch it on); and the isolation and quantification of particular risks. Rather than spending time on studying history, consulting studies and consulting reports such as traffic studies and marketing analyses. The project finance models focus on cash flows accruing equity holders and lenders rather than earnings and the projections generally cover the entire defined lifetime of the project.

Acquisition Model: The third type of model, an acquisition or leveraged buyout model, measures the returns earned from an acquisition transaction which is characterized by the consideration paid for the equity of the company, the holding period of the investment and exit price as well as the manner in which the acquisition is financed. To compute equity returns, acquisition models measure the manner in which alternative financing sources are repaid and ultimately compute the return earned by equity investors.

Merger Model: An integrated consolidation model computes earnings per share and credit quality measures on a standalone and a consolidated basis before and after a merger or acquisition. This type of model considers the specific financing and accounting of the transaction as well as cost savings or synergies generated by the transaction. A common application of this type of model is to evaluate how much can be paid for a company before earnings dilution will occur and bond ratings can be maintained.

Real Estate Model: A real estate model is a cousin of project finance models except that a group of multiple investments in a portfolio are combined together. For example a mixed development model includes different residential properties with different construction start and finish dates as well as different commercial and even industrial properties. Real estate models must be able to evaluate cash flows that are produced at different time periods without a single construction and operation period. Further the models must be able to quantify the effects of different holding period strategies and alternative tax treatments.

Each of the models have a lot in common. They each require up front thought as to the structure and the scope of the model; they each require analysis of timing issues; they each should be segregated into components and begin with layout of operating and financing assumptions; they each should each have verification analyses; they each should have a starting point; they each should not contain bad programming practices; and they each should be structured so as to facilitate effective risk analysis. However, each of the models come along with unique complexities that can make the models un-transparent, in-flexible, in-accurate and un-stable. Complexities associated with the different models include:

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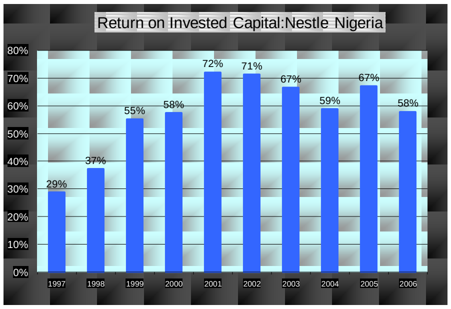
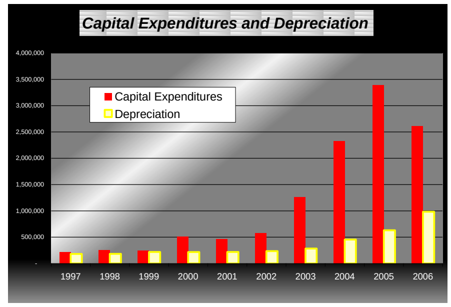
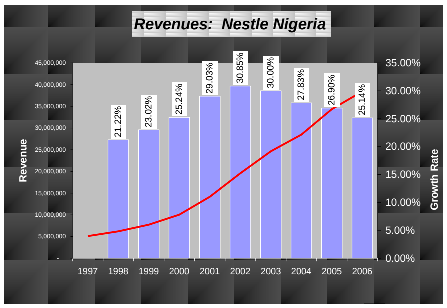
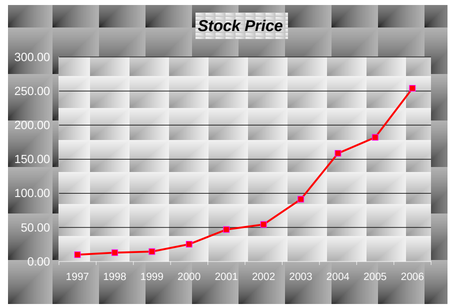
Structure of a Corporate Model

Corporate models are used to compute free cash flow for making valuations using the DCF approach. They are also necessary for making projections of earnings per share; assessing the ability of a company to repay debt; and evaluating the reasonableness of future financial ratios such as return on equity and return on invested capital. The first step in creating a corporate model should be evaluating historic data so as to develop assumptions and understand the financial performance of a company. As part of the historic evaluation, the models can use financial ratios such as return on invested capital, EBITDA margin and credit ratios to tell a story about what has happened to the company. This historic analysis of financial ratios provides an important basis for comparing projections with actual results and it is the most fundamental difference between corporate finance and project finance – in project finance one needs some kind of consulting study or contract because historic trends are not available. For example, one can compare the historic return on investment and the historic EBITDA margin with ratios in the projected period to evaluate whether forecasts are reasonable. Different ratios may be appropriate to paint a picture of different companies: sometimes it may be trends in return on investment; in other situations it may be the ratio of capital expenditures to depreciation; in yet others it may be the interest coverage ratio. A big problem for investors in the case of Constellation Energy discussed in Chapter 1 was that there was no way to really dissect the financials of the company and compute effective metrics that told a story about how the company was taking excessive risks in order to grow. The example below shows how graphs of historic data in a historic model can provide insight as to where value comes from. The company, Nestle of Nigeria, earned returns that were above the cost of capital (the easiest way to compare the return on investment with the cost of capital is to compare returns to the interest rate rather than trying to make sophisticated calculations of weighted average cost of capital.) At the same time, revenues were growing and the capital expenditures were greater than depreciation. This resulted in large increases in the stock price shown in the final panel of the figure.







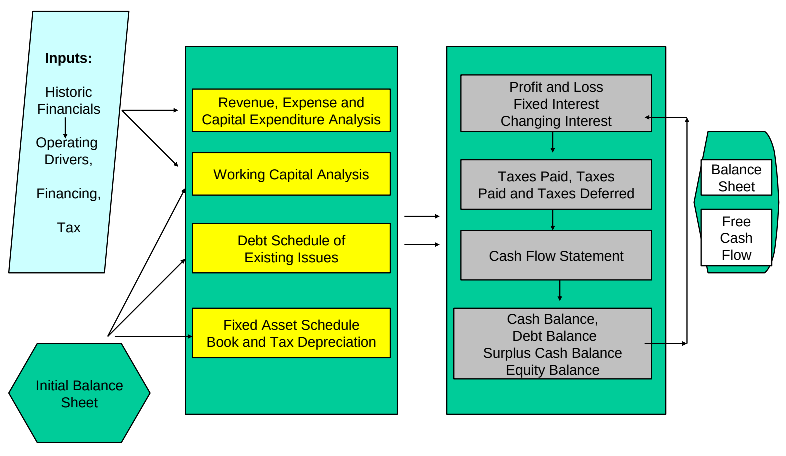


After painting a picture with historic financial statement analysis, structuring a corporate model includes defining how one incorporates history, uses an opening base year balance sheet and connects interest expense and interest income in the income statement to the balance sheet debt through evaluating the cash flow. The process of beginning with a balance sheet and then working through each component of the balance sheet in distinct parts of the model produces a structure which should be transparent and mechanically accurate. In a corporate model, two very simple ideas can dramatically improve the structure of the model. The first is simply realizing that all of the fixed asset accounts, debt accounts, working capital accounts, deferred tax accounts, accumulated depreciation accounts, surplus cash accounts, and other items come straight from the initial balance sheet. The second is setting up accounts for all of these items where the initial closing balance comes from the balance sheet. For example, consider the fixed plant asset account. The closing balance for the account should come straight from the balance sheet. In the subsequent period, the opening balance is the same as the prior period closing balance. Capital expenditures are added to the opening balance (and retirements can be deducted from the balance) to yield the closing balance for the next period. Once the closing balance is established, the same process is repeated for the remaining periods of the model.

The diagram below is intended to illustrate some of the important points about structuring a corporate model. The process begins with analysis of history and the initial balance sheet. The working analysis, the fixed asset balance and the debt schedule shown in the middle column are the essential intermediate steps that should be completed before constructing financial statements. Developing revenues, operating expenses and capital expenditures in the working sheets is just about always the most important part of the analysis. It is generally a good idea to graph history and projections of key variables that drive these three things such as prices, capacity utilization, variable costs and capital expenditures per unit. Once these preliminary parts of the model are complete, financial statements can be constructed. As most of the components of financial statements have already been computed, this part of the analysis, shown in the third column of the diagram, should be quite simple. The main computational challenge in a corporate model is to determine how surplus or deficit cash should be deployed and to develop projections of depreciation and deferred taxes that account for the lifetime of different asset classes. These issues are discussed in detail below. Since a corporation is assumed to last for an indefinite period, the valuation section of a corporate model typically includes an assumption about the value of the company at some terminal date (see Appendix 1 to this chapter). In a corporate model, capital expenditures are made on a continual basis to sustain operations, implying that on-going assumptions with respect to new financing must be developed. The diagram illustrates that connection of the profit and loss statement with the

interest expense and interest income that is a typical characteristic of a corporate model (which can create circularity). The arrow on the right of the diagram is meant to show that interest expense on new debt calculated from the model is not known until the debt balance is computed from the cash flow and interest income on surplus cash is not known until the amount of surplus cash is derived. Unlike project finance models, dividends are determined from an algorithm such as a payout ratio and are not the result of the cash flow process.

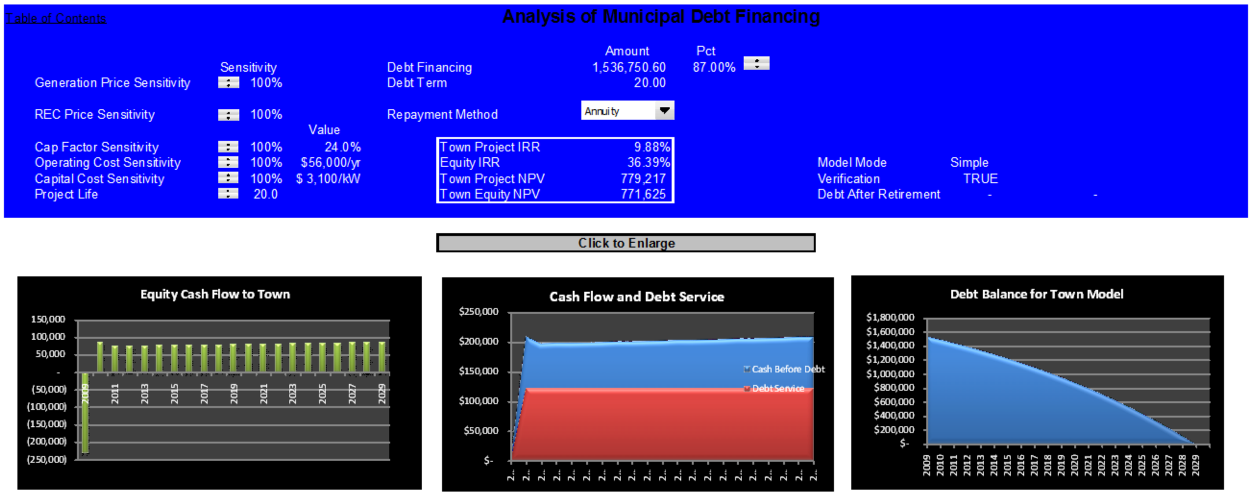
Structure of a Standard Corporate Model



The final column of the diagram on the right shows that the balance sheet is an output rather than part of the mechanical calculations. To make the balance sheet, the common equity balance can be calculated like all of the other balance sheet accounts. As with the other accounts it begins from the opening balance of the equity (in the first year from the initial balance sheet). To compute the closing balance, the net income and equity issuances are added and the dividends and equity buybacks are subtracted. A similar account can be computed for minority interest. With all of the accounts completed including the equity balance, the balance sheet can be computed by simply gathering together the closing balance of all of the accounts. If you want to work through a corporate model structure in excel, complete the first exercise in the corporate model folder.

Structure of a Project Finance Model

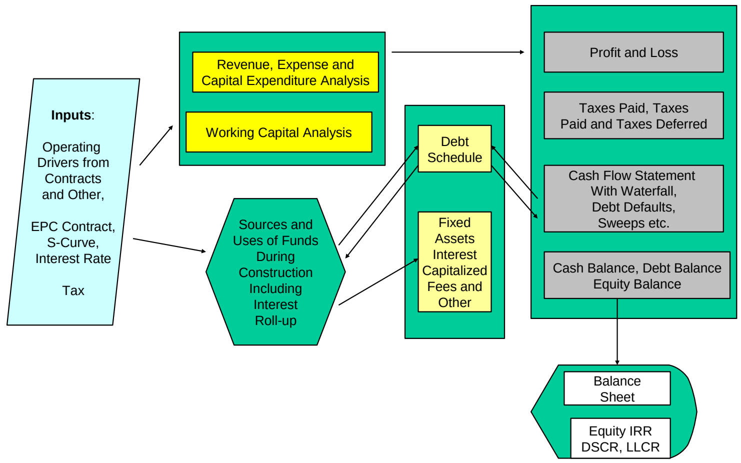
A project finance model contrasts with corporate models that are founded from historic data. Key outputs from the project finance model are related to cash flow: the growth rate of equity cash flows which is called the equity IRR (discussed in detail below); and, the ability of cash flows to cover debt service in each period which is called the debt service coverage ratio (Chapter 4). Project finance models are typically used for two things. The first is to structure the size of the debt, the tenor of the debt and the manner in which debt will be repaid. The second is to assess the risk of the project given the financial structure. Unlike corporate models, the information base for project finance models is a series of contracts, construction budgets, engineering data and possibly projected commodity prices. Given that there is no historical record for a project finance corporation called a special purpose vehicle (SPV) and therefore no historic balance sheet, the launching point for projection of financial statements is a sources and uses of funds during the construction period rather than the balance sheet. An example of outputs from a project finance model is shown in the diagram below. Key drivers of the project such as the capital cost per unit of output, the product price and the utilization are shown together with the IRR and various different ways to measure the debt service coverage.



The structure of a project finance model is illustrated on the diagram below. One of the essential elements of a project finance model is that different calculations are made for distinct phases of the project – the development phase, the construction phase and the operation phase and the debt repayment phase. The sources and uses statement is computed during the development and the construction phase. While the things that go into this part of the model are not complicated to think about – what ones spends money on and how one raises the money – the source and use statement provides a good picture of what the project is about (recall Eurotunnel from Chapter 1). From a mechanical perspective, the sources and uses statement replaces the balance sheet as the starting point for the balance sheet accounts such as the fixed assets, the debt balance, the debt service reserve balance and so forth. This is illustrated in the diagram where arrows from the source and use statement launch the fixed asset schedule and the debt schedule. The working module that computes revenues and expenses is similar to the corporate model as is the fixed asset schedule and the debt schedule. Part of the debt schedule is computing the interest during construction that is capitalized to the cost of the plant.

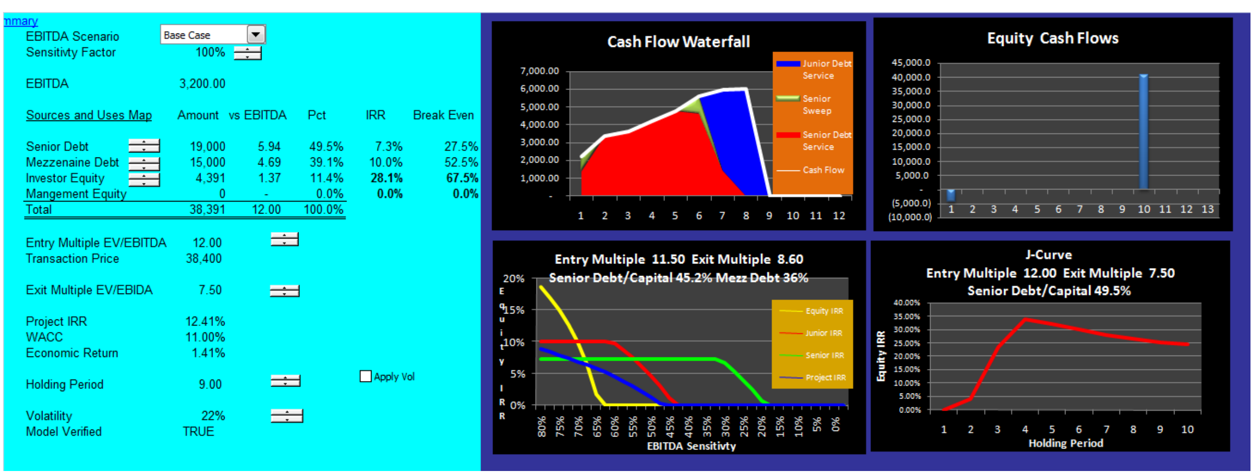
Once the debt schedule is computed, the profit and loss statement and the tax analysis are simple to construct. The most complex part of making financial statements is the cash flow waterfall that defines which investors receive the highest priority of cash flow is often the most complicated part of the process. Since a project is generally a one-off investment where debt and equity investors focus on cash flow rather than accounting earnings, the structure for computing cash flow is also different in a project finance model than a standard corporate model. The final part of the cash flow waterfall is the dividends paid to the owners of the SPV (often called sponsors) meaning that dividends are not defined by a dividend payout, dividend per share or some other algorithm, but rather are the residual cash flow not paid or reserved elsewhere. As illustrated in the diagram below, effective modeling of cash flows involves integration of the debt scheduling with the cash flow waterfall in the cash flow analysis and launching from a sources of funds analysis. Risk analysis of a project finance model is also different phases as the construction period typically involves technical risks and the operation period includes economic risks. Finally, as with the corporate model, the balance sheet is part of the output in which all of the accounts such as plant balance, debt service reserves, senior debt balance, subordinated debt balance and common equity balance are already defined. If you want to get your hands dirty and work through the structure of a project finance model, complete the first exercise in the project finance model folder.

Structure of a Project Finance Model



Structure of an Acquisition Model

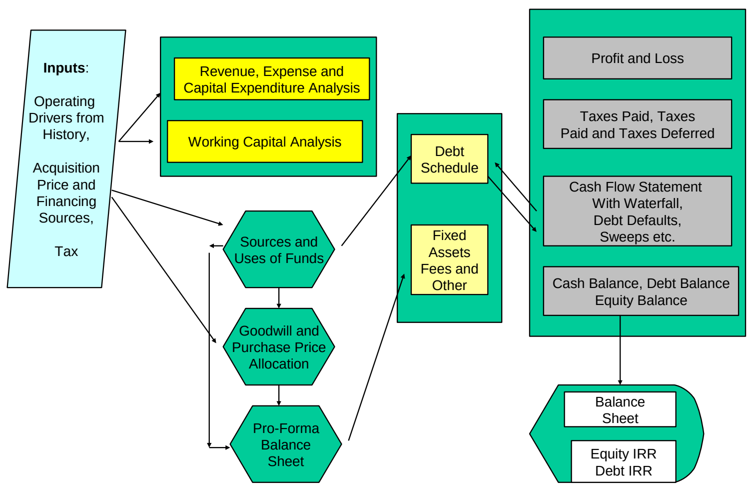
An acquisition model is typically developed to determine how much to pay for a target company and how much of the purchase price can be financed with different types of debt including amortizing debt, debt with a bullet maturity and debt with capitalizing interest (this is sometime known as "ABC.") Key assumptions in an acquisition model include how much operating cash flow can grow with new owners and a new strategy as well as the how much the company can be sold for after the holding period. Financial ratios used in assessing an acquisition are often related to the EBITDA. These include the enterprise value (debt plus equity value) to the EBITDA; the senior debt level to the EBITDA; and the total debt level to the EBITDA. As with a project finance model, an acquisition model can be used for both structuring the amounts of different type of debt as well as risk assessment. The figure below illustrates output from an acquisition model that could include an illustration of how cash is distributed, break-even points and a J-Curve that illustrates optimal holding periods and equity cash flows that drive the equity IRR.



The structure of an acquisition model is illustrated in the diagram below. The diagram illustrates that modeling a leveraged acquisition transaction involves combining some aspects of corporate models and other aspects of project finance models. As with a corporate model, the history of the company should be studied when developing acquisition models. However, as with a project finance model, an acquisition model should begin with a sources and uses analysis that shows how much cash is used for the

transaction and where the cash comes from. After the sources and uses map is established, a goodwill analysis should be added that allows construction of a pro-forma balance sheet. The general structure of computing a pro-forma balance sheet through mapping the sources and uses of funds along with a goodwill analysis that incorporates the accounting aspects of the transaction is shown in the second column of the diagram. Once the pro-forma balance sheet is created, the modeling process contains similarities to both a corporate model and a project finance model. As with a corporate model that works through different asset and liability accounts on the balance sheet, an acquisition model works through accounts where the first year closing balance comes from the pro-forma balance sheet. An acquisition model also has phases as does a project finance model – in particular, the transaction period should be distinguished from the holding period and the terminal period. In addition, an acquisition model also has phases as does a project finance model – the transaction period should be distinguished from the holding period and the terminal period. The right hand side of the diagram shows that the cash flow modeling process is analogous to the methods described for a project finance model where a waterfall progression measures the priority of cash flows to the various sources of funds and ultimately the equity holders.

Structure of an Acquisition Model



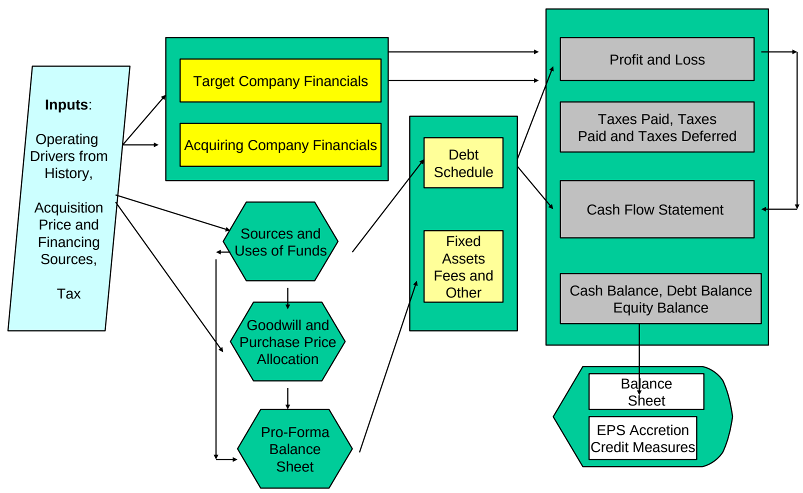
Structure of an Integrated Merger Model

The idea of a merger integration model is evaluate how much to pay for a company and how to structure the financing of a merger. To do this an integrated merger model can be developed that compares earnings per share with a merger and without a merger along with the credit quality of the combined company. The prospective earnings of the combined company depend on how much is paid for the acquisition and how many synergies are generated from changing management. When measuring the cost and benefits of a merger, the information base is the historic operations, projected cost savings and/or revenue increases and transaction terms. The valuation section below illustrates the output of an integrated merger model and explains how the valuation of a target company can be accomplished without worrying about the discount rate or the terminal value.

The diagram below of an integrated model demonstrates that this structure mixes elements of an acquisition model and a standard corporate model. As with the leveraged acquisition model, the starting point of a merger integration model is a sources and uses analysis of the transaction and the pro-forma balance sheet after goodwill and other adjustments. The only difference is that the pro-forma balance sheet begins with existing balance sheets of both the target company and the acquiring company. For an integration model, the transaction assumptions incorporated in the sources and uses analysis may include a share exchange, multiple debt issues and new equity offerings. Once the starting balance sheet established, the remaining calculations of the cash flow process are similar to the corporate model

where computation of net cash flow leads to the accumulation of a net cash balance and the net cash balance is separated between short-term debt and surplus cash liquid investments. The debt schedule shown in the middle column of the diagram includes issues retired in the transaction (shown in the sources and uses analysis) and new issues to finance the merger as well as the associated fees and breakage costs. Shares issued in the transaction could come from offering new shares or from the shares issued to target company shareholders as part of a share exchange transaction. The diagram shows that instead of computing a working analysis to derive revenues, expenses and capital expenditures these numbers come from individual corporate models for the target company and the acquiring company. The most difficult item to project is the synergies that arise from management changes that occur with the transaction. In the real world, these synergy projections must be made with only public information and no time.

Structure of an Integrated Consolidation Model



A comparison of the elements that are included in the layout of different types of financial models is shown in the table below.

	Project Finance	Corporate Model	LBO Model	M&A Integration Model
Information Base	Contracts and analysis of Commodity Prices and other value drivers	Historical financial statements; Analysis of value drivers	Historical financial statements; Analysis of value drivers; Transaciton Terms	Historical financial statements; Analysis of value drivers; Transaciton Terms
Model Starting Point	Sources and Uses Analysis	Historic Balance Sheet	Sources and Uses and Pro-Forma Balance Sheet	Sources and Uses and Pro-Forma Balance Sheet
Cash Flow Process	Cash flow waterfall that ultimately measures dividends paid to equity	Net cash flow after dividends that result in changes in short-term debt or surplus cash	Cash flow waterfall that ends in dividends paid to equity	Cash flow changes that result in changes in short-term debt or surplus cash
Debt Analysis	New Debt Issues from Transaction	New and Existing	New Debt Issues from Transaction	Existing Debt Issues; Retired Debt Issues; New Debt Issues
Model Termination	End of project life	Arbitrary terminal period	Transaction holding period	EPS analysis period
Model Complexities	NOL; cash traps and sweeps; construction period issues; debt service reserves; debt sculpting	NOL; target capital structures; circularity; depreication vintage	NOL; cash sweeps; interest capitalization on sub debt; debt service reserves; terminal period	Pro-forma balance sheet; minority interest changes; new debt issues
Model Output	Equity IRR; Project IRR; DSCR	DCF Valuation; EPS projection; Implied P/E; Credit Quality	Equity and Debt IRRs; Debt/EBITDA	Project EPS and Other Ratios on Standalone vs Combined Basis

Subsequent sections of this chapter discuss issues in creating each of the major model components. In addition to the general description of what should be included in each section, a discussion of some practical programming tips for those who are involved in construction of models on a regular basis.

Avoiding Bad Programming Practices

For purposes of valuation and investment analysis, models do not have to be overly complex with numerous different spreadsheets and tedious detail of items that are relatively insignificant. Most people's reaction to receiving a model with thirty different sheets and excruciating detail of operating expenses is to put the model in a drawer and to do no risk analysis with the model. While effective valuation models may be relatively simple, creating a model that is flexible enough to handle different risks; that accurately measures cash flows; that presents the key value drivers and important outputs in an easily understandable and transparent manner; and that does not crash excel because of circular references requires a disciplined approach to excel programming.

From first-hand experience in developing models that are not well designed, the benefits of setting-up financial models in a careful structured manner and using practices that make the models more accurate and stable become obvious. A well structured model can maybe avoid you having the ghastly feeling of, after completing a model, being asked by a supervisor to open and revise a model that was created a few weeks earlier. This feeling often comes from knowing that you will have to review a long and complex formula with multiple "if" statements that can no longer be interpreted. These types of formulas are generally incomprehensible without completely re-constructing the formula and splitting it up into many different rows.

To avoid incomprehensible, un-transparent and unstable models that are virtually impossible to audit, some companies require use of a set of "best practices" when programming models. While these practices can help, many people become very obsessed with the programming practices and lose sight of the ultimate objective of a model, which is to effectively measure the future cash flows and risks of those cash flows. For example, in order to keep formulas the same across excel columns for the transaction period and subsequent periods, complicated if statements may be developed that are difficult to interpret. Instead of suggesting there is such a thing as best practice, a list of practices that should make a model easier to interpret and modify is presented below:

- Divide the model into separate modules, beginning with input modules and make the inputs a separate color (the word module simply refers to a separate part of the model -- it could be a separate spreadsheet page or simply a segment of one sheet.) When entering inputs in one or more modules, operating inputs should be separated from financial inputs.

- Make calculations of operating cash flows in a separate module to measure how the value drivers result in operating revenues, operating expenses and capital expenditures in a working analysis. This means that elaborate revenue or expense calculations should not be directly in financial statements. The calculations in the working sheet should be as transparent as possible through repeating inputs and including all of the factors that are used in making various computations.

- Include separate modules for debt issues, fixed plant assets, working capital and cash balances. The debt module should include the interest rates, interest expenses, repayment mechanics, pre-payment possibilities, financing fees and potential for default. The fixed plant asset schedule should include calculation of book and tax depreciation.

- Carefully specify the time period of the model using time period codes that define alternative phases of the analysis.

- Work through every single balance sheet item showing the opening balance, additions and subtractions from the account and the closing balance for each the accounts. This analysis should be made for everything single title in the balance sheet ranging from cash accounts to common equity.

- Limit or avoid the use of macros and iterations to resolve circular references as circular references are not present in the real world and fixing circularity makes many risk analysis programming techniques more difficult.

- Use the balance sheet and other items as auditing tools and include a separate "integrity" page of the model to present verification checks. Include a "dashboard" at the top of each page of the model to monitor the integrity and key outputs of the model.

- Assure that no formulas in the output module of a model affect anything in any other section of the model. This means that you should be able to delete the output section without causing any reference errors in the mechanical calculation parts of the model.

- There should be no inputs in any part of the model other than the input page. One of the worst and most obvious problems is to include inputs as part of a formula; these partial inputs are difficult to find and make the models inflexible.

- Make sure that spreadsheet columns are consistent throughout the model and that the formulas for each column are identical (with the possible exception of the very first period in corporate models and acquisition models.)

- Keep formulas in the model as simple as possible and clearly delineate how each formula is derived from the inputs (this is often a problem with long "if" statements). Long formulas can be avoided by splitting formulas into multiple different rows and by using TRUE/FALSE switches.

- Test various balances such as the debt balance, the net asset balance, the reserve balance and other items relative to the opening balance. The MIN function together with the opening balance puts a cap on things that can lead to negative balances. For example, the scheduled debt repayment can be capped at the opening balance – you do not want to pay more than the existing balance back to the bank.

- Use the positive number convention which means that individual items are shown in the model as positive numbers and subtotals are explicitly shown as additions or subtractions. For example, capital expenditures are listed as positive in the cash flow statement with the caption "less: capital expenditures" and cash flow after capital expenditures subtracts the capital expenditures.

The above principals seem obvious when written down in a book. However, in the midst of creating a model to meet a deadline, it is very easy to ignore these principals as they seem to slow you down when working under a tight deadline. Examples of bad practices include entering input data in the fifth sheet of a model; including complicated revenue and expense calculations with long if statements directly in the income statement; forcing the balance sheet to balance using a cash item; computing interest expense without separately listing debt issues and not integrating financial statements. The single worst practice that is often made by otherwise very good modelers is to make formulas that are too long. An example of a formula (for projected prices) that is almost impossible to verify is shown below:

```
=IF(AB5<14,IF(AB2=6,AA39*(1+inflation),AA39),IF(AB5=14,'OperatingInputs'!$E$103/'OperatingInputs'!$E$104,IF(LEN(AB5)=2,AA39,AA39*(1+inflation))))
```

This formula, taken from an actual model, contains a number of bad practices. One problem is that fixed numbers are included in the formula (i.e. the number 14 and the number 6.) The larger problem is that the formula is far to complex to easily verify and audit. This formula could be vastly improved if one would split it up into a number of separate rows where one would show the inflation rate in a separate row, the tests in separate rows and the alternative results of different conditions in various rows. Indeed, when asked to review somebody else's model, it is a good idea to split up formulas like this one. This formula took about fifteen rows and once the more transparent separate rows were presented, several obvious errors were apparent.

A few practical tips for creating a well structured model are described below. Other practical tools that can be helpful in structuring a model are included in the file named "fm.xls" included on the accompanying CD.

Practical Tips for Good Modeling Practice

This section describes various programming techniques that implement some of the above ideas. If you are interested in general modeling concepts rather than the implementation details or you want to be able to read models but not to program them, you should skip the detailed discussion of practical programming and begin reading the next section on time periods and valuation.

Short-cut keys and Setting-up the Model Area

In structuring a model it is helpful to set-up the model so that you can work with the model in an efficient manner. The more a model can be created with excel short-cuts rather than using the mouse, the faster you will be able to develop and modify the model. (In some financial modeling courses imposed on young bankers, the mouse is removed from computers so students learn how to navigate around spreadsheets much more quickly, lest they waste a minute in creating collateralized debt securities out of sub-prime loans.) Use of short-cut keys may seem a bit odd when you first use them instead of the

mouse, but if you practice, they really can make your work on the model easier. One of the most helpful shortcuts is the combination of the following two keystrokes that allows you to very quickly copy and paste rows in a financial model:

1. Press the SHIFT,CNTL, → (right arrow) at the same time to mark a row, and
2. Press CNTL,R to copy the formula or data to the right.

The problem with this short cut is that it copies the contents of the first cell to each column of the sheet, all the way to the right end of the sheet. To limit the copying of columns to the maximum rows of your sheet – the maximum number of periods that you may forecast, you can hide the columns for which you do not want the item to be copied. To hide columns to the right of the model periods, you can group all of the columns to the right of the last column in your program. To use this method, use the SHIFT,ALT,→ combination to group columns and press the number 1 on the top left corner of the spreadsheet as summarized below:

1. Shade the entire column of the first column to be hidden (you can used the CNTL, Spacebar combination)
2. Press the SHIFT, CNTL, → to shade the remaining columns in the sheet
3. Use the SHIFT, ALT, → combination to group the remaining the selected columns.
4. Press the Number 1 in the square box at the top left of the sheet.

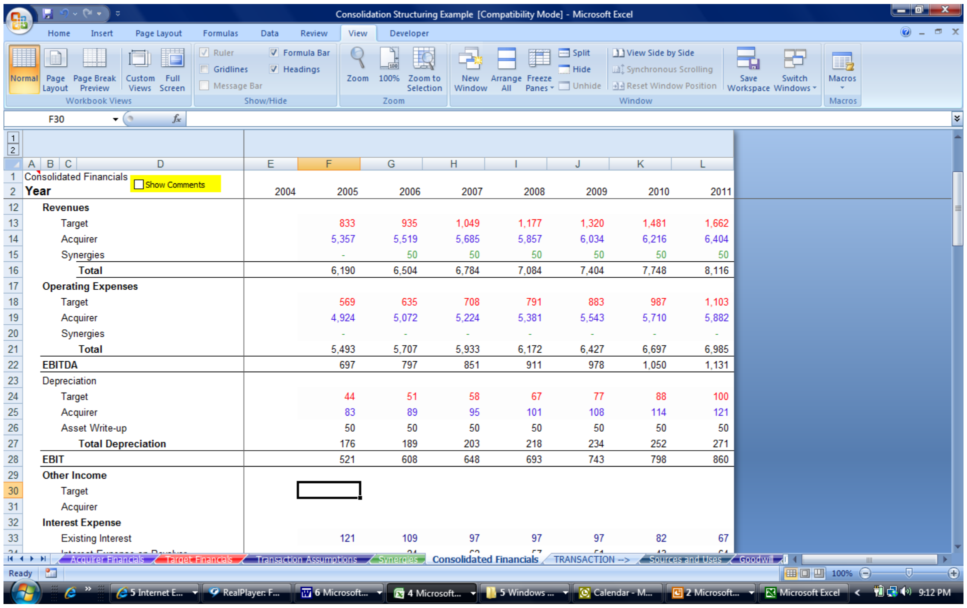
If you need the columns to the right, you can press the number 2 button instead of the number 1 key. Results of the grouping approach are shown on the diagram in the next section where the right part of the sheet after the columns have been grouped is grey. Many other short-cut keys and hints are included in the excel background folder of the accompanying CD.

Color Conventions

In a well structured financial model, colors should be used as a guide to what is happening in various cells of the model. This means the colors should not be used to make the model into an attractive piece of art, but it is better that they provide readers of the model with a quick understanding of where the numbers in a cell come from. One principle is that input cells should be colored differently from other cells, generally through using the fill color and the background color. There are few methods to color inputs. A simple method is to use the F5 key and then the press the special key. An alternative method is to use a macro provided in the CD (a set of macros is included on the accompanying CD that allows you to automatically find each input set the color.) It is a good idea to show a color key in the input section or the table of contents of a model.

A second principle is that a different font color should be used for cells in which data comes from another sheet. For example, if price data is transferred from the input sheet to the workings sheet, that cell should have a color to notify users in what sheet they can quickly find the source of the data. A macro that sets the font color of a cell from the tab color of the sheet included with the materials. Other colors can be used for cells that have been computed from the goal seek or the solver and for cells that are computed through the operation of a macro. Finally, cells in which calculations are made from information in the same sheet should not have a font or a fill color.

The example below illustrates a couple of the excel set-up ideas discussed above. The sheet (from an integrated consolidation model) is set-up using the SHIFT, ALT, → method to limit the size of the sheet with the grouping method (when you press 1 at the top left, the columns are hidden, while when the number 2 is pressed, the columns are unhidden.) The red cells come from the target company financials which has a red tab color while the blue cells come from the acquirer sheet that has a blue tab color. Finally, the example illustrates that it is a good idea to make a few small columns on the left of the spreadsheet so that it is clear what rows are sub-totals and headings.



	Consolidated Financials	2004	2005	2006	2007	2008	2009	2010	2011
2	**Year**	2004	2005	2006	2007	2008	2009	2010	2011
12	**Revenues**								
13	Target		833	935	1,049	1,177	1,320	1,481	1,662
14	Acquirer		5,357	5,519	5,685	5,857	6,034	6,216	6,404
15	Synergies		-	50	50	50	50	50	50
16	**Total**		6,190	6,504	6,784	7,084	7,404	7,748	8,116
17	**Operating Expenses**								
18	Target		569	635	708	791	883	987	1,103
19	Acquirer		4,924	5,072	5,224	5,381	5,543	5,710	5,882
20	Synergies		-	-	-	-	-	-	-
21	**Total**		5,493	5,707	5,933	6,172	6,427	6,697	6,985
22	**EBITDA**		697	797	851	911	978	1,050	1,131
23	Depreciation								
24	Target		44	51	58	67	77	88	100
25	Acquirer		83	89	95	101	108	114	121
26	Asset Write-up		50	50	50	50	50	50	50
27	**Total Depreciation**		176	189	203	218	234	252	271
28	**EBIT**		521	608	648	693	743	798	860
29	**Other Income**								
30	Target								
31	Acquirer								
32	**Interest Expense**								
33	Existing Interest		121	109	97	97	97	82	67

Use of TRUE and FALSE Switches and Model Integrity Page

Setting up a model where a series of mechanical checks can be automatically monitored is effective when building and using a model. A useful technique is placing a "dashboard" on each page of the model that shows key outputs, inputs and sensitivity analysis switches. In addition, the dashboard on each page should show an overall check on the integrity of the model – does the balance sheet balance, is the cash balance positive, are the dividends non-negative, do the sources of cash equal the uses of cash and so forth. Sometimes it is useful to include a series of checks as to whether debt is in default as well as mechanical checks.

An effective way to set up the integrity check of a model is to use TRUE and FALSE logical variables. The use of TRUE and FALSE switches is helpful in many parts of the model. For example, it eliminates the need for painful "if" statements that can be very difficult to audit and the variables can be used to test covenants and run the model in different modes of operation. A TRUE/FALSE variable can be created by simply using and equal sign (for example, =1=1 is TRUE). Variables that have a value of TRUE or FALSE are helpful because the =AND function can be applied with a series of logical variables to test if the overall value is TRUE (analogous to the sum command for number.) Further, when if statements are used, they can be used with the TRUE or FALSE in the logical section of the statement. A prominent verification check is to test whether the balance sheet balances in every period and it is good practice to show each balance sheet item in a different module of the model. The following step by step process illustrates verification with the balance sheet test.

Step 1: After computing the balance sheet, subtract the assets from liabilities

Step 2: In a separate row, use a TRUE/FALSE logical variable (created by setting one cell equal to another) to test whether the difference, after rounding, is equal to zero. (The rounding is necessary because the difference is often not precisely equal to zero if, for example, there is a division by three somewhere in the model).The formula is =ROUND(difference,0) = 0.

Step 3: Once such the TRUE/FALSE result is established for each period, the =AND function can be used to test whether the balance sheet balances in every single one of the periods. Specifically, the AND function is used on a range of TRUE/FALSE logical variables and placed to the left or the right of all of the year by year tests.

Step 4: Link the TRUE/FALSE result from the AND statement to a page of the model that contains other verification checks (for example, in a project finance model or an acquisition model, check whether the sources of funds equal the uses of funds.)

Step 5: Create a separate verification page that combines the balance sheet test with other tests (again using the =AND function) to develop a test for the overall integrity of the model.

Step 6: Identify the sections of the model that have problems using an if statement that uses the title of the test and the result of the test. The if statement has the form:

IF(test,"",title)

For example, when applying the balance sheet test, the test in the above formula would be the aggregate TRUE/FALSE test from the model. The title would be something like "Balance Sheet Test")

Step 7: Once the sections of the model with problems are identified, make an aggregate presentation of all of the problems in the model. This cell can then be placed in each sheet and each sensitivity analysis to allow you to find problems without looking around the model each time. The aggregate presentation has the form:

=problem1&problem2&…..&problem10

Where the problem1, problem2 and so forth come from Step 6. The "&" function allows the text to be put together (as if you were adding things.) For better presentation, it is a good idea to put a space before each title so the problems are delineated.

Step 8: Place the final aggregate presentation of problems with the model in the dashboard that monitors each page of the model.

The figure below illustrates the verification of the balance sheet that feeds into an aggregate balance sheet test. The row labeled "test" uses a switch and the ROUND function to make sure the balance sheet balances in each period. If all of the tests are TRUE, then the aggregate test computed with the AND function is also TRUE.

	8-Sep-08	31-Dec-08	31-Dec-09	31-Dec-10	31-Dec-11	31-Dec-12	31-Dec-13	31-Dec-14
Balance Sheet								
Plant Assets	990.00	1,030.00	1,071.60	1,114.86	1,159.86	1,206.65	1,255.32	1,305.93
Less: Acc Depreciation	-	15.40	66.90	120.48	176.22	234.22	294.55	357.31
Net Plant	990.00	1,014.60	1,004.70	994.38	983.64	972.44	960.77	948.62
Senior Debt	306.90	222.51	140.33	41.04	-	-	-	-
Mezz Debt	336.60	369.92	406.55	446.79	348.01	165.50	-	-
Equity	346.50	422.16	457.83	506.55	635.63	806.94	960.77	948.62
Total	990.00	1,014.60	1,004.70	994.38	983.64	972.44	960.77	948.62
Difference	-	-	-	-	-	-	-	-
Test	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Aggregate	TRUE							

In addition to mechanical tests of the model, tests of whether a model is in default on any debt issues should also be developed. In a project finance model and/or a leveraged acquisition model, one of the key questions is whether cash flow is sufficient to pay all debt service and make required payments into debt service accounts and other requirements. If the cash is not sufficient, then defaults occur and ultimately with low enough cash flow, debt cannot be repaid. When the debt cannot be paid, the model should clearly present default on a dashboard. These issues can be addressed with the same type style of programming as the verification tests. For example, a test can be established for default on debt service reserve accounts and a test for negative cash flow. An example of a page that shows verification checks is illustrated in the figure below.

Check Title	Test	Problem Identification	Formula
Sources and Uses	TRUE		=IF(E3,"",D3)
Non Zero Debt Balance	TRUE		=IF(E4,"",D4)
Dividend	TRUE		=IF(E5,"",D5)
Debt Percent > 100	TRUE		=IF(E6,"",D6)
Target DSCR <> Actual DSCR	FALSE	Target DSCR <> Actual DSCR	=IF(E7,"",D7)
Leverage More than 100%	TRUE		=IF(E8,"",D8)
Negative CADS	TRUE		=IF(E9,"",D9)
Fixed Debt Service = Applied	FALSE	Fixed Debt Service = Applied	=IF(E10,"",D10)
Balance Sheet	TRUE		=IF(E11,"",D11)
Aggregate Test	FALSE	Target DSCR <> Actual DSCR Fixed Debt Service = Applied	=F3&F4&F5&F6&F7&F8&F11&F9&F10
Dasboard Presentation ---->		Target DSCR <> Actual DSCR Fixed Debt Service = Applied	=IF(F13="","Model Ok",F13)

Use of Range Names to Structure and Document Models

When entering data, the cell references such as “B2” can be renamed using range names such as “holding period”. For most people in the world, the question of whether or not to use range names in a financial model is not very interesting. But amongst financial modelers, the issue of when to use range names for data can become a heated debate. Some suggest that every row in a model should have a range name such as revenues, costs and EBITDA. This can be accomplished using the SHIFT, CNTL, F3 short-cut which forces the range names to be documented and allows one to revise the range name. With range names in the spreadsheet, the model formulas are documented (for example, the formula in excel is EBITDA = revenues – costs rather than C5 = C4 – C3.) Further, the use of range names forces all formulas in the sheet to be consistent across columns because if the row name is used in a column (the formula is defined using SHIFT, CNTL, ENTER) then once cannot change the formula definition across a single row. Finally, if the model is structured with range names, one cannot mix up the years by putting the year 2010 in one column in one place in the model and then put another item for 2010 in another column in the model.

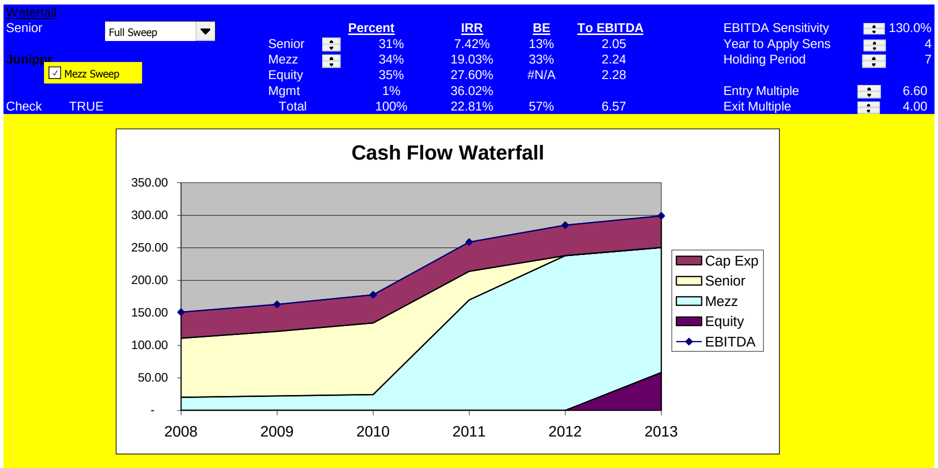
While some insist on range names in models, others argue that over use of range names is not helpful because the original source of formulas (e.g. B5 x AB92) is lost (e.g. int_rate x debt_bal). This means that without cell references in formulas, the model may be somewhat more difficult to trace. Further, if a named range is deleted, the model becomes unstable as the formulas can no longer be computed. If one copies a sheet that contains range names to another sheet, the range names do not transfer. Similarly, if one combines files two different files together that each contain the same range name, then excel must decide which range name to use. Finally, using range names can make the model more tedious to program, particularly for the opening balance sheet period in a corporate model and the transaction period in an acquisition model.

While the range name debate is not an exiting subject to most people, a compromise is probably best for most financial models. Some inputs such as the holding period, the plant life or the acquisition price may be useful to name. Further, use of range names is very beneficial, if not essential, when the inputs are used in macros, when inputs are used in forms (combo boxes, spinner boxes and so forth)

Setting-up a Dashboard

When there are multiple sheets in a model, it is nice to show a dashboard in which you can change different items and you can show outputs as shown on the example below. It is also helpful to show the model verification switch in the dashboard. This is very simple to add to each sheet after you have worked on the model if you use range names for the output variables and you have structured forms in the model to work with multiple sheets. The simplest way to create forms is to make an extra working sheet and refer the cell links to different sheets. In this way the forms can be copied from one sheet to

another while retaining the cell links in the appropriate sheet. When creating a dashboard, it is useful to use range names for all of the inputs and outputs shown on the page so that the dashboard can easily be copied to added spreadsheet pages. The example below illustrates use of a dashboard for a leveraged acquisition transaction. The drop-down boxes and spinner boxes may seem a bit like a gimmick, but they can be used to effectively summarize the key inputs and the key risks in a transaction. With these buttons, one can evaluate different capital structures, different operating cash flow levels in terms of return as well as risk. In this case, the risk is measured as the break-even cash flow that can support the level of senior and mezzanine debt before the return falls below the risk free rate.



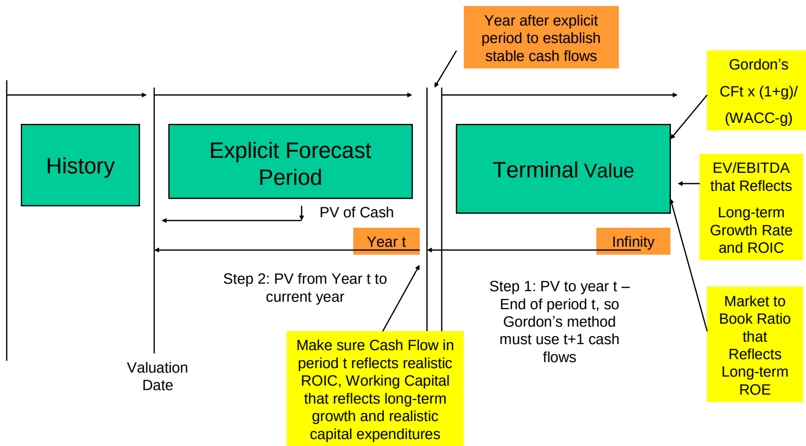
Time Period Structure and Valuation

A seemingly trivial but important part of the process of developing a model is setting-up dates and time period codes that classifies different various phases of a transaction. Efficiently structuring the time periods assures that you can you to gauge the effect of issues such as the length of the holding periods of an acquisition, delays in the construction of a large project, lengthening of the life of an investment, or the amount of time before which a stable growth rate is achieved. From a mechanical perspective, carefully setting-up time periods allows calculations of items such as interest during construction, terminal value, depreciation and amortization, debt service reserve repayments, gain on sale of assets and other items.

Corporate Models and Terminal Period

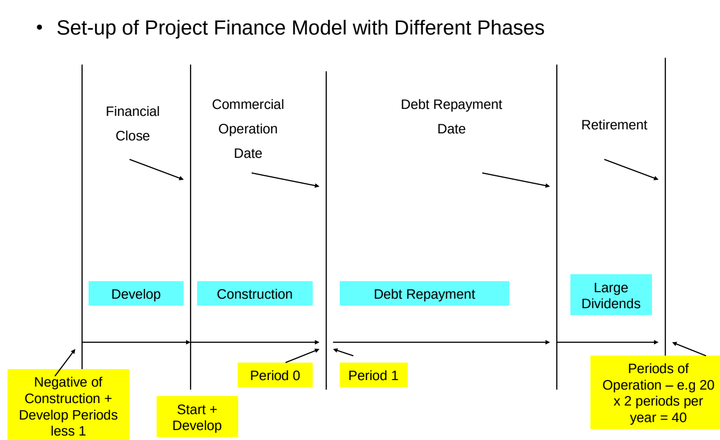
A corporate model encompasses a historic period, an explicit forecast period, a terminal period and sometimes a fade period. For a corporate model, the structure of time periods should begin with a base period which is the balance sheet of the final historic period. It is a good idea to label this base period as zero so that the explicit forecast period begins with one and increase thereafter. Given the subjectivity of estimating future growth, it is useful to be construct the model so as to be able to evaluate different periods before which the explicit forecast period ends. Finally, corporate models can be structured to include a fade period in which cash flow growth declines from the rate achieved in the terminal cash flow period until a stable growth rate is obtained. The diagram below illustrates different time periods in a corporate model and the importance of the assumptions developed for the final forecast period.

Terminal Value in Corporate Model



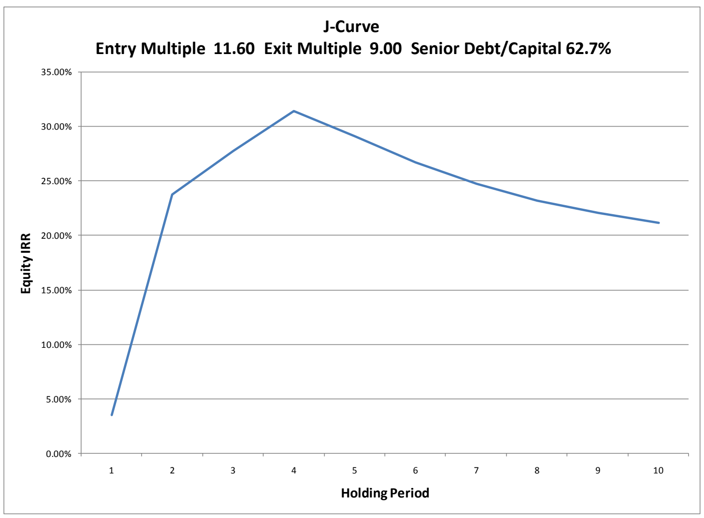
Project Finance Models and Different Phases

Structuring the dates is particularly important in project finance models where different accounting, financing and risks occur in the different periods. These different stages that occur when making a new investment typically include the time period when the project is being developed before construction – the development period; the period when construction occurs and investors are putting money into the projects; the period of operation of the project, and finally, the period in which the project terminates. The mechanical calculations in a model and the risks are different for these different time periods. Further, the length of the periods in a model often varies for the different phases of a project. In many models, the construction period is presented on a monthly basis in order to accurately measure interest during construction since the calculation requires accumulation of debt for each month. On the other hand, when the plant begins operation, the model switches to semi-annual periods because of debt is repaid on a semi-annual basis. In order to construct time periods, one can create switches that define each phase of the project as well as the important millstone dates such as the financial close and the commercial operation date. The programming of different phases can become quite complex if the millstone dates do not start at the beginning of a month and if there are different time periods modeled in each phase of the project. The essential practice is to make a period code which is one at the commercial operation date, negative during operation and development and measures the age of the project. The figure below illustrates how various stages of a project can be modeled with a period code. The mechanics of developing the various switches is discussed in the section below.



Acquisition Models – Transaction Period and Exit Period

In the case of acquisition models, it is also important to spend some time setting-up time periods. In this case, separate switches can be developed for the acquisition period, the holding period, and the terminal period. The acquisition period should be a separate period in the model that only lasts one day so that the mechanics of the on-going calculations are not mixed up with the transaction assumptions. The period subsequent to the acquisition period can be a fraction of a year followed by annual periods until the final sale period. The exit period should also be separate from the holding period in order to isolate on assumptions with respect to the sale of the company. Developing periods in this manner allows the model to handle movements in the transaction date as well as alternative holding periods of the investment. With the holding periods defined, a J-curve illustrating how the rate of return is affected by the length of time between the purchase and sale can be established as illustrated in the graph below.



Use of TRUE and FALSE Switches for Modeling Time Periods

Mechanically, the definition of periods can be developed by defining the various dates and then programming separate variables that contain switches that define the phase of the project. After defining the dates and periods of various phases, logical variables (TRUE or FALSE) that define each phase of the model with switches can be created. For example, the terminal period in a corporate model would have a value of FALSE for each period except for the terminal period, which has a value of TRUE. If the model is set up beginning with zero for the last historical year, then the logical variable for the terminal period is simply programmed to be when the terminal period equals the time period.

Use of the logical variables that have a value of TRUE or FALSE is helpful because TRUE is equal to one and FALSE is equal to zero. A switch can be created by simply using and equal sign (for example, = period <= 0). It can also be created using and AND, OR, or NOT function (for example, AND (period > 0, period <= retirement date) defines a switch for when the plant is operating. Establishing the TRUE and FALSE statements is also effective with if statements. One can simply use the TRUE or FALSE in if statements and make the statements much easier to read.

The step by step process for setting up dates at the beginning of the sheet includes:

Step 1: Input months per period for various phases of the project – typically one month for construction period and six months for operating period.
Step 2: Develop period code – this is an essential part of the process, the last date before operation is period zero and the project begins its life in period one. It does not matter at all that the length of some periods is different than other periods. The start period of construction is the negative of the number of construction months minus one. For example if the start date of construction versus the completion date yields 40 months, the first period is negative 39. Then, the first period of construction will be zero as desired. (Note: it is a good idea to hide remaining columns)
Step 3: Develop switches (TRUE/FALSE) for different phases and important dates – construction period, operation period and terminal period.
Step 4: Correspond the months per period from the switches. For example, for the construction period, the months per period is one.
Step 5: Enter the dates using the EDATE function. Show both the beginning date and the ending date. The first beginning date is the established date and the ending date is the EDATE function with using the months per period. The beginning period in the second period is the ending period plus one day.
Step 6: Compute the number of days per period and the days in 360 day year (first period next year)

Once the switches are established, a number that defines the number of months per period can be computed that differentiates the construction period from the operation period through multiplying the switch by the twelve divided by the periods per year multiplied by the switch. For example, if the construction period has is monthly, then the periods per year is twelve divided by one or twelve and if the operating period is semi-annual, the periods per year is twelve divided by six or two.

If the dates do not begin at the first day of the month, then the EOMONTH function should be used rather than the EDATE function. Further, the ending month must change fir different millstone dates including the start of the project development, the financial close and the commercial operation. For all other months, the ending date is the end of the starting month that can be computed with the EDATE function. A final complication results because the time periods are not constant and must be adjusted if the start date is more or less then the middle of the month. An example of setting up dates with different phases for a project finance model is included in the reference CD.

Tips for Computing Start and End Dates for Each Period

Once the period length for project phases, the switches, and the period codes have been defined, the dates of the model can be established. The dates cannot be incremented by simply adding numbers to the starting date. For example, you cannot add 30.5 to the last date, and have each month begin at the first day of the next month. Instead, you can use the EDATE function or the DATE function. If the EDATE function is used, then the excel analysis tool pack must be added in and the formula is simply EDATE (prior period, periods per year). If the DATE function is used, the YEAR, MONTH and DAY arguments of the function should refer to the previous date and the period per year should be added to the MONTH argument. Given the definition of periods for year from the switches above, the DATE function would be DATE(YEAR(prior date), MONTH(prior date) + periods per year, DAY(prior date)). After the dates have been computed, it is a good idea to explicitly show the start date and the end date for the period and the number of days in the period. In addition, the number of days in a 360 day period should be shown using the DAYS360 function so that interest expense or interest income can be computed per the appropriate convention.

To set-up a model that accounts for different project phases, a few excel techniques are helpful. First, the total construction period should be defined by subtracting the completion date from the date at which construction begins (the construction start date and the completion date should be defined in the model along with the number of periods per year for construction and the number of periods per year for operation.) Through defining dates in this manner, the model can be flexible enough to account for delays in construction of the project. To compute the start date in this manner on a monthly basis, use the DAYS360 function in excel and enter the start date of construction and the completion date

(DAYS360(start date, completion date), then divide this number by 30. To illustrate this process consider the following example:

> Start date of construction: 1-March-2010
> End date of construction: 1-December-2015
> DAYS360 (begin, end) : 270
> Divide by 30 : 69

The issue of developing dates is more complex when the periods do not occur at the beginning of the month. In this case, you should use the EOMONTH rather than the EDATE function. Much of the other process is the same – you should still define the number of months per period and the start and the end of the period. In this case, the EDATE function is defined with the opening date minus one month as illustrated below.

Tips for Converting Periodic Data into Annual Data

It is simple to annualize periodic cash flows once the fiscal year has been established. This can be accomplished by listing the year below the date and then using the SUMIF function to sum the periodic cash flows within the year. Converting a periodic model into an annual model is often necessary for presentation and can be very useful in reviewing the model. To demonstrate the process, the establishing the fiscal year is discussed and then the process of using the conditional sum is described.

Establishing the fiscal year can be demonstrated by considering the example of Microsoft Corporation. For this company, the fiscal year 2007 ends at June 30, 2007 and covers the period July 2006 through June 2007. Here, one would define the fiscal year as June. For programming purposes, January through June correspond to the current calendar year (2007) and the later months, July through December, correspond to the prior fiscal year. In project finance models, for convenience, the fiscal year should in the month just before commercial operation. With this assumption, the first year covers a full year of operation. For example, if construction ends in May and the project begins in June, the fiscal year should end in May. Then, the first fiscal year would cover the period from the beginning of June at commercial operation to the next June. Once the month of the fiscal year is established, one can use the YEAR function along with the MONTH function along with an if statement to determine the fiscal year of alternative periods. For the example above where the fiscal year ends in May, if the month is less than to June, the fiscal year equals the calendar year. On the other hand, when the month is greater than June, the fiscal year is the next calendar, or the calendar year plus one.

Once the fiscal year has been established, the periodic cash flows can be converted into annual cash flows for balance accounts that record the balance at end of the year and for cash flow or profit and loss accounts that accumulate amounts into the annual periods. The following step by step process walks through the process and allows one to very quickly convert periodic cash statements to annual statements.

Step 1: Compute Fiscal year

> If the month of the opening date is ***less than*** the fiscal month, (e.g. June) then the fiscal year is the same of the calendar year (e.g. 2007). (For example, for months of January through May, the year is 2007.)
>
> If the year of the opening date is ***greater than or equal*** to the fiscal month (e.g. July), the year is the calendar year plus one (e.g. 2007+1). (In the example above, June through December are set to 2008.)

Step 2: Copy titles of cash flow, balance sheet and other items to a separate section or a different sheet. Enter the year of for the report on the top of the sheet as well as the month number of the fiscal

year. Then use the date function to create the ending date of the fiscal year (see the figure below).

Step 3: Use a TRUE/FALSE switch to identify codes that are accumulated over the year and the accounts in which balances are taken from the end of the fiscal year period.

Step 4: Apply the SUMIF function, where the initial range is the fiscal year definition, the criteria is the year and the sum range is the cash flow item. To make this work shade the entire row of the fiscal year in the periodic section of the model (click on the row number to shade the entire row) and then fix the references (press the F4 key). Next, refer to year entered for the report in step 2 above and use a relative reference to lock-in the row number but not the column name (press the F4 key twice). Finally, refer to the range to be summed by clicking on the entire row without locking in the row number or the column number. This process will work for the cash flow items to be accumulated over a period.

Step 5: Use a similar process using the SUMIF function to apply to the balance accounts. In this case the sum range is the date itself and the criteria is the ending day of the fiscal year. This means that the only items are summed when the fiscal year data used in the criteria of the SUMIF formula is the same as the date in the periodic section (sheet of the model.) To make this work, shade the entire row of the end date in the periodic section of the model (click on the row number) and then fix the references (press the F4 key). Next, refer to fiscal year end entered for the report (see the diagram below) and use a relative reference to lock-in the row number but not the column name (press the F4 key twice). Finally, refer to the range to be summed by clicking on the entire row without locking in the row number or the column number as with the accounts to accumulate.

Step 6: Use an if statement with the TRUE and FALSE switches (create a relative reference on the column name of the switch) and copy the same formula for each row in the sheet.

Financin Month of Fiscal Year		9	9	9	9	9	9	9	9	9
Year		2007	2008	2009	2010	2011	2012	2013	2014	2015
Fiscal Year End Day		30-Sep-07	30-Sep-08	30-Sep-09	30-Sep-10	30-Sep-11	30-Sep-12	30-Sep-13	30-Sep-14	30-Sep-15
Power Output	**Accumulate/ Balance**									
Plant Capacity (kW)	FALSE	600	600	600	600	600	600	600	600	600
Capacity Factor	FALSE	29.7%	29.7%	29.7%	29.7%	29.7%	29.7%	29.7%	29.7%	29.7%
Annual Degredation Factor	FALSE	0.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Daily Degredation Factor	FALSE	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Degredation Index	FALSE	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92
Capacity Factor with Degredation	FALSE	29.7%	29.4%	29.1%	28.8%	28.5%	28.3%	28.0%	27.7%	27.4%
Availability Period	FALSE	1.00	1.00	2.00	3.00	3.00	3.00	3.00	3.00	3.00
Plant Availability	FALSE	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Number of Hours in Period	TRUE	-	8,784	8,760	8,760	8,760	8,784	8,760	8,760	8,760
Gross Generation (MWH)	TRUE	-	1,549.77	1,530.23	1,515.08	1,500.08	1,489.25	1,470.48	1,455.92	1,441.51
Paracetic Load	TRUE	-	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Total Net Generation (MWH)		-	1,529.77	1,510.23	1,495.08	1,480.08	1,469.25	1,450.48	1,435.92	1,421.51

Tips for Beginning a Model with Dates Do Not Start at the Beginning of a Quarter or a Month or a Year

In most situations an acquisition or a project finance venture or even an valuation analysis with a corporate model does not conveniently begin on January 1st of a year for annual models, or April 1st, July 1st or October 1st for a quarterly model and the beginning of the month for a monthly analysis. Many times it is not worth the effort to incorporate start dates that are not the beginning of a period and one can simply assume the project or acquisition occurs that the beginning of the relevant period. However, occasionally it may be necessary to incorporate start dates that are not at the beginning of a period. Unfortunately, this is a painful process and there is no quick and easy trick to accomplish the task. A

general approach to deal with the issue of start dates that are not consistent with desired period begin and end dates is discussed below:

1. First, you should establish the date of the first full period of a model. For example, if the start date of a project is 19th of January and the model is a monthly model, then the date of the first full period is 1st of February while if the model is a quarterly model, the first full date is 1st of April.

2. Once the date of the first full period is determined, then this date is used as the end of the first period and the beginning of the second period. Once the second period is established, the end dates of subsequent periods can be established as described above using either the EDATE or EOMONTH function.

3. Given that periods of the model will be uneven – specifically that the number of days in the very first period is different from days in the other periods, the technique that computes daily growth rates and then compounds the growth on a daily basis should be applied as described above.

4. If you are entering factors that depend on the life of a project or the life of an acquisition – for example the growth rate for the first year of an acquisition may be negative – one must allocate the growth between periods. This occurs in periods when the year changes. For example, if the project begins on 1st September and the model is annual, some of the first year growth rate must be allocated to the second full year of the model. To accomplish this one can create a partial year factor and compute the percent of the period attributable to the current age and the percent of the project attributable to the prior age.

It is simple to annualize periodic cash flows once the fiscal year has been established. This can be accomplished by listing the year below the date and then using the SUMIF function to sum the periodic cash flows within the year. To demonstrate the process, the establishing the fiscal year is discussed and then the process of using the conditional sum is described.

Establishing the fiscal year can be demonstrated by considering the example of Microsoft Corporation. For this company, the fiscal year 2007 ends at June 30, 2007 and covers the period July 2006 through June 2007. Here, one would define the fiscal year as June. For programming purposes, January through

Inputs, Workings Analysis and Value Drivers

The most important part of the modeling process is to accurately define and analyze input items that drive the value of an investment and effectively present how the risks of the value drivers affect the ultimate value. Indeed, the general objective of programming tips presented in this chapter is that you will hopefully have more time to study the drivers of value. The drivers of cash flow generated from any asset are things like forward prices, capacity utilization ratios, plant efficiency ratios, input prices, fixed and variable cost and the capital cost per unit of capacity to build the plant. The modeling and valuation mistakes discussed in the last chapter were not due to incorrectly structuring a model or making incorrect calculations in the model, they were the result of not using valid economic and financial principles in developing inputs to the valuation process. Other parts of the book deal with how to develop inputs for prices, discount rates, volumes sold, operating costs and other inputs. These inputs can be studied by reviewing historic data, performing statistical analysis, applying marginal cost concepts, and considering industry structure. In addition the value drivers should use judgment as to whether sudden non-linear changes can occur, industry expertise and perhaps mathematical simulation. This section describes more mundane issues concerning how to structure, document and present inputs in a financial model.

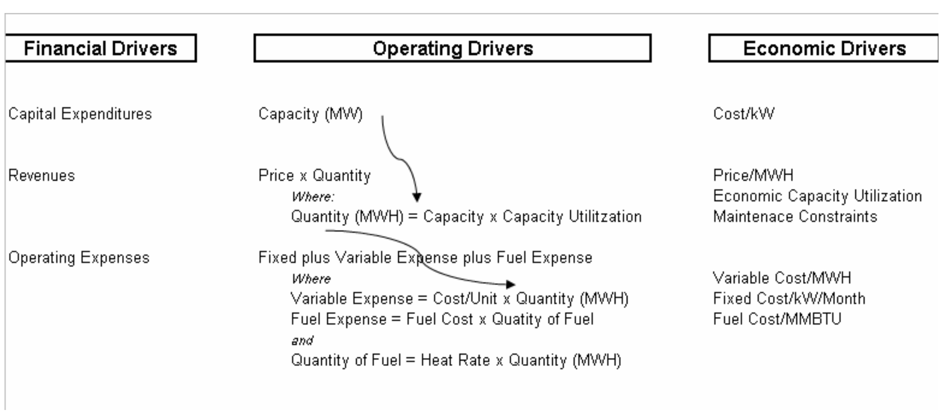
Structure of Inputs

The most important point about inputs is of course the assumptions that are behind the numbers. However a couple of notes with respect to the structuring of inputs in a model is worth summarizing. The

most important element in setting-up inputs is that the data should be classified in a manner so that the data can be easily found. The inputs should be on the same page (or set of pages) and the relevant input categories should be grouped together. If scenarios are developed, a separate page or area should contain all inputs for the scenarios including the base case and alternative scenarios. First, the inputs should be set-up in a way that anybody can easily find the inputs and understand exactly what each input means. For example, a model has a input labeled “development percent” would be confusing because one has no idea what is the basis for the percentage. Second, the inputs should allow the model to be adjusted and not be restrictive. For example, when there is one inflation rate applicable to all future years, the model obviously has limited flexibility. Third, the inputs should be arranged in a logical manner and grouped together by categories. Separate sections can be shown for inputs for the general transaction – dates, purchase prices and so forth; operating revenue and expense drivers; capital expenditures; financing parameters; and tax assumptions and other items. Fourth, no matter how tempting, outputs from the model should not be mixed together with the model inputs. Finally, when using the inputs in other sections of the model, the inputs should be repeated and not used in the middle of the calculations.

Value Drivers; Supply Driven Models versus Demand Driven Models

In setting-up a financial model it is best, whenever possible, to begin with the capacity or demand of the company or project. The starting point should generally be the capacity of the company or the project in a supply driven model or the demand for the product in a demand driven model. To demonstrate the difference between demand and supply driven models consider an upstream oil project. The most likely place to begin the upstream model is with the capacity of the oil fields in terms of oil and gas reserves implying the model would be supply-driven. You would not begin with an analysis of the worldwide demand for oil because oil prices the company operates in a commodity business and it will most probably sell whatever it can produce. Alternatively, for a company operating in a limited market region that may have market power, the model would begin with demand for the product and market share of the company. that has a The diagram below illustrates how the value drivers should be connected to one another in a model in order to produce revenues, expenses and capital expenditures for developing cash flow models and valuing investments.



Most time in the valuation and modeling process should concentrate on statistical and economic analysis of the inputs that are have the most significant effect on value – the value drivers. The true art of modeling is quickly identifying these value drivers and then developing reasoned projections of what could happen to these inputs in the future. This analysis can range from simple graphing of historic data to complex regression analysis of mean reversion tendencies to judgment with respect to political risks. As a side note, value drivers are not items such as revenue growth, operating margins, return on investment or the ratio of capital expenditures to sales. These are statistics that are the result of the economic position of a company or a project, not the items that are the ultimate source of value.

When setting-up a model, it may seem that establishing an inflation index is straightforward and simply a matter of multiplying one plus the inflation rate by the prior inflation index. One must be careful in defining the base period for which prices are defined and escalate from that period. Difficulties can arise when time period lengths change and when intervals are used for inputting the inflation rate. Discussion of looking-up data using the MATCH and INDEX functions is discussed later. The step by step process below illustrates how to deal with varying periods. This process involves converting annual rates into daily rates and computing the index from the number of days in the period. The procedure is analogous to verification of the XIRR discussed in the output section

Step 1: Convert the annual rate into a daily rate using the formula (1+Annual Rate)^(1/365)-1.
Step 2: Beginning with 1.0 for the base period, compound the index through multiplying the prior index by (1+daily rate)^(days in period)

(Also cannot have positive of zero cash flow in first period in XIRR)

Excel Tips for Data Validation

When entering data, the data validation tool in excel can be useful in assuring that the data you have entered is valid. The tool can also be useful in documenting the source of inputs. You can make sure the data is entered is in the intended range (such as a number between zero and one), you can make sure the sum of a series of data inputs accumulates to one (such as depreciation rates) and you can assure that a data input is within a given set of numbers. To use the data validation tool, select the validation option from the data menu. If you simply want to make sure the data is a decimal value between zero and one, select the decimal option from the settings option. Then enter zero for the minimum and one for the maximum. To validate that the sum of depreciation rates sum to 1.0, Data validation techniques; use of match command to link data to appropriate periods in a flexible manner.

Setting-up Scenarios with Forms, and INDEX Command

One of the most important uses of models is to develop risk analysis. To prepare the model of risk analysis, one should set-up the model in anticipation of the risk analysis through entering different possible scenarios in the data input section. The task is to enter the data without inordinately cluttering up the model. This can be accomplished through entering data and then grouping the data. In addition, use of forms together with the INDEX or CHOOSE command is generally effective. The process of setting-up scenarios is summarized below:

Step 1: Enter different scenarios for an input item by simply typing the different scenarios on a set of rows.
Step 2: Enter a row number corresponding to one of the scenarios in an open cell somewhere in the spreadsheet.
Step 3: On a blank row below the list of scenarios, use the CHOOSE or the INDEX function along with the selected row to create the chosen scenario (the row number should be fixed so the function can be copied across the rows.
Step 4: Use the selected scenario as the variable in the model.

If you would like more specific guidance on creating scenarios, please refer to the file named scenario and sensitivity analysis on the CD.

Excel Tips for Looking up Data with MATCH and INDEX

In developing indices of inflation, growth, and loan pricing grids, inputs can be presented using a grid that shows the from date, the to date and the input item. For example, the credit spread on a loan may vary by year and also according to a financial ratio as shown in the example below where the model is created on a monthly basis, but many of the inputs are developed on a calendar year basis.

Credit Spread					
DSCR		From	2009	2012	2015
From	To	To	2012	2015	2050
1.00	1.3		1.50%	1.60%	1.70%
1.30	1.5		1.30%	1.40%	1.50%
1.50	2.5		1.25%	1.35%	1.45%

In order to array the credit spreads in the above table with both years and the debt service coverage ratio, one can use either VLOOKUP or the HLOOKUP functions or the MATCH together with the INDEX function. To array the values where there is space between the values, the "from" year can be used with the lookup or the match commands. The MATCH command can use either 1, 0, or -1. The value of 0 means there must be an exact match of the value, while the 1 is used for ascending values and -1 is used for descending values.

Fixed Asset Schedules and Depreciation

Introduction and Simple Assets Schedule

Once the debt schedule is established, it is useful to develop a separate module which establishes asset balances as well as the book and tax depreciation on an asset. Other assets on the balance sheet that are explicitly considered in a model such as investments, debt issuance cost associated with capitalized underwriting fees and operating reserve accounts can also be included in this section of the model. A separate account can be created for the book balance of assets and the tax balance of assets if there is a difference in depreciation methods or the basis for depreciation.

In its most simple form, the fixed asset schedule for a corporate model, acquisition model or an integrated model begins by defining the closing balance with the book balance from the balance sheet – in an acquisition model this is the pro-forma balance sheet. This should be the gross balance of plant where the gross plant balance is separated from the accumulated depreciation. The reason for separating the gross balance and the accumulated depreciation is so that the depreciation rate can be applied to the appropriate base. Once the closing balance is defined from the balance sheet, the opening balance is of course the prior closing balance. The account then increases with the capital expenditures defined in the working section. With the closing balance of plant defined, the depreciation expense can be defined as the plant balance multiplied by the rate. Use of the opening balance, average balance or closing balance depends on the assumptions made with respect to timing elsewhere in the model. If the cash flows, debt repayments and other items are assumed to occur at the end of the period, then the opening balance should be the base for depreciation expense. If the cash flows are assumed to occur in the middle of the period, then the average balance should be used. Finally, an account should be established for the accumulated depreciation. This account begins with the closing balance from the balance sheet and is incremented with the depreciation expense.

The method described above is often good enough for simple valuation problems where taxes are not a major part of the valuation and the explicit valuation period is fairly short. If the depreciation rate is multiplied by the balance of gross plant, as described above, the progress of the net plant (i.e. gross plant less accumulated depreciation) is correct as capital expenditures are added. However, this simple method results in overstatement of depreciation because retirements of assets reduce both the balance of gross plant and the balance of accumulated depreciation. The overstatement comes about because the gross plant is not reduced by retirements – the gross plant just goes up with the addition of capital expenditures.

In a project finance model, establishing a fixed asset schedule can be relatively simple as well. A couple of differences are that an initial balance sheet is not used to develop the asset schedule; retirements do not bias the results; the tax depreciation is more important than the book depreciation; and, depreciation does not begin until the commencement of operation and the capitalized interest is included in balance of the plant. To address the issues, a gross plant balance account should be established which increases with the construction costs as well as the interest during construction. To begin the depreciation at

commencement of operation, the tax depreciation rate (which may vary with the age of the project) is multiplied by the balance of the plant as well as operating switch. As with the non-project finance models, the accumulated depreciation should be computed after the depreciation expense is established.

Adjusting the Tax Basis in an Acquisition

For tax purposes, acquisition can be treated as a purchase of assets or a purchase of stock. This tax treatment must be distinguished from the book accounting for an acquisition which results in re-valuation of assets and re-establishing the equity. If the acquisition involves a purchase of assets of assets rather than the purchase of stock, the acquisition price should be more as the asset base will be higher and the value of depreciation deductions increase. In evaluating an acquisition, comparative multiples should account for the difference in value from purchase of stock versus purchase of assets as the multiples should account for the difference in tax rates for different countries. If the acquisition is stock, no write-up for tax purposes occurs, the seller does not pay tax on gain realized from selling asset and the buyer can use the exiting net operating loss. Since the tax depreciation deductions take place over an extended period while the taxable gain must be paid immediately, from the perspective of both the acquiring company and the target company on a combined basis, a stock transaction generally has a positive outcome because the gain on the sale is taxable as current income while the write-up is deducted on a periodic basis. Therefore, on a present value basis, the government treasury wins and the combined shareholders of the two companies lose. In situations with net operating loss, the situation is even worse as the value of the net operating loss carry-forward is lost.

To establish the tax and book depreciation expense in alternative transaction structures, the following steps can facilitate the development of a model:

1. The existing deferred taxes can be used to derive the existing difference between the tax and book base through dividing the accumulated deferred tax by the income tax rate.

   Existing Basis Difference = Accumulated Deferred Tax/Income Tax Rate

2. Given the valuation of the assets, the tax basis increases as the book basis of the assets increases, but the tax basis does not change. The difference in the basis increases the balance of accumulated deferred tax as demonstrated in the formula below.

   Accumulated Deferred Tax after Transaction =
   (New Book Basis – Existing Basis) x Income Tax Rate

3. When computing the goodwill for developing the pro-forma balance sheet, the increase in assets as well as the increase of accumulated deferred tax must be accounted for. In addition to other goodwill adjustments, the goodwill formula should include:

   Goodwill = Goodwill – Increase in Asset Valuation – Increase in Accumulated Deferred Tax

4. For an acquisition, in the fixed asset schedule, the existing assets can be split from the new assets. When modelling the fixed asset schedule, the retirements should be modeled as well as the additions. Retirements should be deducted from both the plant balance and the accumulated depreciation balance. The reason for splitting the assets in this manner is the difference in treatment of asset retirements and the difference in depreciation rates. Existing assets can be depreciated over the remaining life of the assets while the new assets should be depreciated over the various asset lifetimes. Retirements of new assets can be computed using the lifetime of the assets while retirements of existing assets can be modeled with a retirement rate. The modelling of retirements using a retirement rate can be computed using a simple formula that multiplies the opening balance by the rate while the retirements of new

assets can be modeled using the offset command as described below. Some formulas for existing and new assets include:

Existing Gross Assets = Beginning Balance – Retirement Rate x Beginning Balance
New Asset Balance = Beginning Balance + Construction – Retirements
Existing Accumulated Depreciation = Beginning Balance + Depreciation - Retirements
New Asset Accumulated Depreciation = Beginning Balance + Depreciation - Retirements

5. The depreciation on exiting assets should not exceed the balance of net plant. To assure that the depreciation expense does not exceed the net plant, the minimum function can be used as demonstrated in the formulas below:

   Depreciation Expense = Minimum(Plant Balance x Depreciation Rate, Opening Net Plant)

The process of computing depreciation, deferred taxes and cash flow in an acquisition is included in an exercise that is part of the CD and the website. One of the tricky excel techniques in computing the retirements is use of the OFFSET command to develop retirements. This function allows you to go backwards and find the retirements from the capital expenditures. The function works by starting with a cell reference – in this case the current capital expenditure. Then, the cell reference can be moved up or down, forward or backwards through inputting row and column parameters. Through keeping the row the same and putting the negative of the life as the column input, the retirement is the capital expenditure that occurred in the life span of the assets. For example, if the book life is seven and the current capital expenditures are 100 and the capital expenditures eight years ago were 70, then the offset command would use the cell with the 100 as a reference and then go backwards by seven years to find the 70 which is the retirement. There is a problem with this command because before the model reaches the retirement, the OFFSET command will result in an error. This means the OFFSET command can only be used for periods after the life of the asset. To solve this problem, use an IF statement and do not put anything in for the false condition – this will leave a FALSE which is equal to zero.

Illustration of the process is shown in the two figures below. The first figure demonstrates how retirements, net plant and deferred taxes are treated for existing plant. Note that as expected the accumulated deferred taxes related to existing plant reaches a balance of zero.

Existing Assets - Book																				
Opening Balance		5,200.00	4,940.00	4,693.00	4,458.35	4,235.43	4,023.66	3,822.48	3,631.35	3,449.79	3,277.30	3,113.43	2,957.76	2,809.87	2,669.38	2,535.91	2,409.11	2,288.66	2,174.23	2,(
Less: Retirements		260.00	247.00	234.65	222.92	211.77	201.18	191.12	181.57	172.49	163.86	155.67	147.89	140.49	133.47	126.80	120.46	114.43	108.71	1
Closing Balance	5,200.00	4,940.00	4,693.00	4,458.35	4,235.43	4,023.66	3,822.48	3,631.35	3,449.79	3,277.30	3,113.43	2,957.76	2,809.87	2,669.38	2,535.91	2,409.11	2,288.66	2,174.23	2,065.51	1,9
Retirement Rate		5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	
Depreciation Rate		13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	
Depreciation Expense		650.00	617.50	586.63	557.29	529.43	502.96	477.81	453.92	431.22	393.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Accumulated Depreciation																				
Opening Balance		0.00	390.00	760.50	1,112.48	1,446.85	1,764.51	2,066.28	2,352.97	2,625.32	2,884.05	3,113.43	2,957.76	2,809.87	2,669.38	2,535.91	2,409.11	2,288.66	2,174.23	2,(
Less: Retirements		260.00	247.00	234.65	222.92	211.77	201.18	191.12	181.57	172.49	163.86	155.67	147.89	140.49	133.47	126.80	120.46	114.43	108.71	1
Add: Depreciation		650.00	617.50	586.63	557.29	529.43	502.96	477.81	453.92	431.22	393.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Closing Balance	0.00	390.00	760.50	1,112.48	1,446.85	1,764.51	2,066.28	2,352.97	2,625.32	2,884.05	3,113.43	2,957.76	2,809.87	2,669.38	2,535.91	2,409.11	2,288.66	2,174.23	2,065.51	1,9
Net Plant	5,200.00	4,550.00	3,932.50	3,345.88	2,788.58	2,259.15	1,756.19	1,278.38	824.47	393.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Existing Assets - Tax																				
Opening Balance		1,750	1,663	1,579	1,500	1,425	1,354	1,286	1,222	1,161	1,103	1,048	995	946	898	853	811	770	732	
Less: Retirements		87.50	83.13	78.97	75.02	71.27	67.71	64.32	61.10	58.05	55.15	52.39	49.77	47.28	44.92	42.67	40.54	38.51	36.59	
Closing Balance	1,750	1,663	1,579	1,500	1,425	1,354	1,286	1,222	1,161	1,103	1,048	995	946	898	853	811	770	732	695	
Retirement Rate		5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	
Depreciation Rate		13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	
Tax Depreciation Expense		218.75	207.81	197.42	187.55	178.17	169.26	160.80	30.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Accumulated Depreciation																				
Opening Balance		400.00	531.25	655.94	774.39	886.92	993.83	1,095.38	1,191.86	1,160.99	1,102.94	1,047.79	995.40	945.63	898.35	853.43	810.76	770.22	731.71	6
Less: Retirements		87.50	83.13	78.97	75.02	71.27	67.71	64.32	61.10	58.05	55.15	52.39	49.77	47.28	44.92	42.67	40.54	38.51	36.59	
Add: Depreciation Expense		218.75	207.81	197.42	187.55	178.17	169.26	160.80	30.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Closing Balance	400.00	531.25	655.94	774.39	886.92	993.83	1,095.38	1,191.86	1,160.99	1,102.94	1,047.79	995.40	945.63	898.35	853.43	810.76	770.22	731.71	695.13	6
Net Tax Basis	1,350.00	1,131.25	923.44	726.02	538.46	360.29	191.03	30.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Tax Less Book Depreciation		-431.25	-409.69	-389.20	-369.74	-351.26	-333.69	-317.01	-423.69	-431.22	-393.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Tax Rate		40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	
Change in Deferred Tax - Existing Plant		-172.50	-163.88	-155.68	-147.90	-140.50	-133.48	-126.80	-169.48	-172.49	-157.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Accumulated Deferred Tax - Existing Plant	1,540	1,367.50	1,203.63	1,047.94	900.05	759.54	626.07	499.26	329.79	157.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Modelling the new assets involves the OFFSET command as described above. Note that before the life of the plant has been reached, the result of the retirement row is FALSE. The OFFSET command is modeled using the formula:

Retirements = IF(Period >= Life, OFFSET(Capital Expenditures,0,-Life))

New Assets - Book															
Opening Balance		0.00	103.00	209.09	318.36	430.91	546.84	666.25	789.23	915.91	1,046.39	1,180.78	1,319.20	1,461.78	1,505.63
Add: Capital Expenditures		103.00	106.09	109.27	112.55	115.93	119.41	122.99	126.68	130.48	134.39	138.42	142.58	146.85	151.26
Less: Retirements		FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	0.00	103.00	106.09
Closing Balance	0.00	103.00	209.09	318.36	430.91	546.84	666.25	789.23	915.91	1,046.39	1,180.78	1,319.20	1,461.78	1,505.63	1,550.80
Book Depreciation Rate		8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%
Book Depreciation		0.00	8.58	17.42	26.53	35.91	45.57	55.52	65.77	76.33	87.20	98.40	109.93	121.81	125.47
New Assets - Tax															
Opening Balance		0.00	103.00	209.09	318.36	430.91	546.84	666.25	789.23	915.91	943.39	971.69	1,000.84	1,030.87	1,061.79
Add: Capital Expenditures		103.00	106.09	109.27	112.55	115.93	119.41	122.99	126.68	130.48	134.39	138.42	142.58	146.85	151.26
Less: Retirements		FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	0.00	103.00	106.09	109.27	112.55	115.93	119.41
Closing Balance	0.00	103.00	209.09	318.36	430.91	546.84	666.25	789.23	915.91	943.39	971.69	1,000.84	1,030.87	1,061.79	1,093.65
Tax Deprecaition Rate		13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%
Tax Depreciation Expense		0.00	12.88	26.14	39.80	53.86	68.36	83.28	98.65	114.49	117.92	121.46	125.11	128.86	132.72
Tax Depreciation Less Book Depreciation		0.00	4.29	8.71	13.27	17.95	22.79	27.76	32.88	38.16	30.72	23.06	15.17	7.04	7.25
Change Deferred Tax - New Depreciation		0.00	1.72	3.48	5.31	7.18	9.11	11.10	13.15	15.27	12.29	9.23	6.07	2.82	2.90

Portfolios of Assets with Vintage Process

Computation of depreciation can be complex when the depreciation rate is not constant for each year. In this situation, the age of the asset must retained to compute depreciation. This can make detailed computation of depreciation one of the most difficult parts of the modeling process. To do this, the following steps can be used:

Step 1: Enter the depreciation rate by year for category.
Step 2: Use the TRANSOPSE function (not the copy and paste special) to set up a matrix that has the year the asset was created on the column and the year of the model on the row
Step 3: Compute the age of the plant and allow the age to be negative in years before the asset was created (use relative references and create a range name such as AGE)
Step 4: Use the HLOOKUP function to relate the depreciation rate to the vintage of the plant
Step 5: Multiply the depreciation rate by the cost of the asset being depreciated from the cost of the asset that was created from the TRANSPOSE function.
Step 6: Repeat the process for assets with different vintages and with book and tax depreciation.

Computation of Major Maintenance and Other Reserve Accounts

In project financing and sometimes in other transactions, cash reserves are used to accumulate money for the prospective payment of major maintenance expenditures. Examples of such expenditures include the overhaul of a wind turbine or the periodic re-surfacing of a toll road. At first blush it seems that the modeling of these reserves is not a very complex matter – we can just add a switch for the maintenance period and then assure that enough money is accumulated in the reserve accounts to assure that funds will be available to pay for the maintenance. Unfortunately, there are pesky programming issues with testing for the maintenance period, computing the contributions to the reserve by looking forward to the prospective maintenance period, and adjusting for the final portion of the life of a project after which maintenance will not be required. Programming techniques that are useful for calculating the reserves include establishing a switch for the maintenance period, using an IF statement for the establishing the remaining periods until the next expenditure, applying the OFFSET function to find the prospective amount of money required for the reserves and creating a separate switch for determining when contributions occur. For a basic case where maintenance occurs on a regular basis, the step by step process includes:

Step 1: Calculate two switches for the maintenance period with and without period zero. This process includes the following

Calculate the remaining life of the project along with the project age – this is simply the total project life minus the age of the project. In the last period, the remaining life should be zero.

Create a switch that uses the MOD function with the age of the project and the maintenance period as illustrated below. When the MOD function is zero and the switch is TRUE, then either the period is a maintenance period or the period is zero, the last date of construction. This switch is referred to as the Mod switch in the discussion below.

MOD(period, maintenance period) = 0

In addition to this switch, another switch that does not include the first zero period should be computed. This can be accomplished through multiplying the first switch by the operating period as illustrated below:

Maintenance Switch = Mod switch x Operating Period Switch

Step 2: Calculate the remaining periods until the next maintenance expenditure

In order to determine the contributions made to the maintenance fund, it is helpful to compute the remaining periods. With the mod switch, you can compute the number of periods from the current period until the next maintenance period. To do this you can use in IF statement that resets the remaining period to the maintenance period when mod switch is TRUE. When the mod switch is not true, the remaining period is the prior remaining period minus 1 as illustrated below:

Remaining Period = IF(Mod switch, Maintenance Period, Remaining Period – 1)

Step 3: Compute a switch for making contributions to the fund

One of the difficult parts in modeling the maintenance reserve is making sure the correct contributions are made in the relevant period. In period is a maintenance period, then the contribution should reflect costs of the earlier calculation rather than the next period. This means the switch should be staggered and begin one period earlier than the operating period. It should also not be true if the remaining life is more than the remaining period computed above. The formula is the following:

Contribution Switch = (Period >= 0) x (Remaining Life > Remaining Period)

4. Compute the base for making contributions with the offset function

To compute the base for the contributions to the fund, you must find the amount of the next expenditure. This can be accomplished with the switch computed above and the offset function that looks forward to the next expenditure as illustrated below. In the offset function, the zero means that the row is not adjusted and the remaining periods means that as the period progresses until the maintenance expenditure period. When the period is equal to one of the maintenance periods, the offset function refers to the next prospective maintenance period.

Prospective cost = IF(Construction Switch, OFFSET(expenditure,0,remaining periods)

5. Compute the contributions to the fund with a prior period adjustment

As stated above, an adjustment must be made to adjust for the fact that during a maintenance period, the prospective cost above is computed for the next period rather than the current period. If there is inflation in the maintenance cost, this causes an error because during the maintenance period, the current cost must be used rather than the prospective maintenance. To make the

adjustment, you can simply set the contribution equal to the prior period prospective cost divided by the periods of maintenance.

An illustration of the process for computing the maintenance reserve is shown on the table below. The various rows correspond to the discussion above. As with other issues, there is an exercise on the CD that allows you to work through the formulas yourself.

Working Analysis													
Initial Period	-1												
Age of Project	-1	0	1	2	3	4	5	6	7	8	9	10	11
Remaining Life	38	37	36	35	34	33	32	31	30	29	28	27	26
Construction Switch	TRUE	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
Operating Switch	FALSE	FALSE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Maintenance Test - MOD	FALSE	TRUE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
Maintenance Period	0	0	0	0	0	0	1	0	0	0	0	1	0
Maintenance Expenditure	-	-	-	-	-	-	100.00	-	-	-	-	100.00	-
Remaining Periods	-1	5	4	3	2	1	5	4	3	2	1	5	4
Contribution switch	0	1	1	1	1	1	1	1	1	1	1	1	1
Base for Contributions	FALSE	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Preliminary Contribution Calculation	0.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Adjusted Contributions - Prior period	0.00	0.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Reserve Account													
Opening Balance	-	-	-	20.00	40.00	60.00	80.00	-	20.00	40.00	60.00	80.00	-
Add: Contributions	-	-	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Less: Expenditures	-	-	-	-	-	-	100.00	-	-	-	-	100.00	-
Closing Balance	-	-	20.00	40.00	60.00	80.00	-	20.00	40.00	60.00	80.00	-	20.00
Balance at End of Life	0												
Test	TRUE												

When the expenditures do not occur in equal periods but are input so as to occur in specific periods and specific amounts, the process is somewhat more complex. In this case rather than using the MOD function discussed above, the MATCH and INDEX functions can be applied.

Profit and Loss Statement and Taxes

Once a working module that computes revenues, expenses and working capital is established, as well as the depreciation schedule and the debt schedule, the profit and loss statement should be simple to calculate. The EBTIDA is given by the revenues and cash operating expenses on the income statement. Depreciation and amortization (DA) from the fixed asset module is then subtracted resulting in EBIT. After computing EBIT, interest expense is subtracted and interest income is added resulting in EBT. For project finance and acquisition models, the interest expense and interest income is taken from the debt schedule. For corporate models, the short-term interest expense and the interest income cannot be computed until the short-term debt and surplus cash is computed. With EBT, book taxes are subtracted by multiplying the EBT by the tax rates and subtracting minority interest overall earnings can be computed.

Cash taxes are a somewhat more difficult than deriving book profit, although the calculation is not too painful if taxes are structured properly when setting-up a model. The computation of taxes can have an important effect on capital intensive projects such as renewable energy projects where rapid tax depreciation may be allowed, but the taxable income is not sufficient to use all of the tax deductions (including high levels of interest expense at the beginning of the modeling period.) As with the other mechanical issues regarding construction of a model one of the most important elements is simply not to be afraid to either read or construct the tax section of models. An effective way to compute taxes paid is to add a separate tax schedule that lays out the taxes paid from a net operating loss carryforward analysis. Incorrect computation of taxes paid and simplistic accounting for taxes can cause major problems in measurement of cash flow and valuation.

Computation of Taxes Paid and Taxes Deferred

A modeling process that will model taxes is to first compute the taxes on the books and the cash taxes actually paid. After the income statement is completed, the EBT from the income statement can be used as the first item of cash tax analysis. From the EBT, adjustments can be made that convert the EBT for books into the EBT for taxes. One of these adjustments involves adding back book depreciation and then deducting tax depreciation. Once the adjustments are made, the taxable income for purposes of computing cash taxes can be computed. After the taxable income is derived, adjustments for a net operating loss carryforward can be made. This involves determining the balance of the net operating loss and making adjustments that increase or decrease the carryforward balance. Once the cash taxes are established, the change in deferred taxes can be calculated along with the accumulated deferred tax. To compute the taxes paid and the taxes deferred, one can following the following step by step process in a module below the income statement.

Step 1: Create a row that repeats the EBT from the income statement.
Step 2: Adjust the book EBT for depreciation and other items that cause cash taxes to differ from the taxes reported on the book profit and loss statement.
Step 3: Set-up and account that maintains the net operating loss balance including the opening balance, the additions that occur when there is negative taxable income and the deductions that occur when the net operating loss is used to reduce taxes that would otherwise be paid when there is taxable income.
Step 4: Compute the amounts deposited into the account from negative taxes through converting the negative amounts into positive numbers.
Step 5: Calculate the amounts removed from the operating loss balance through determining the minimum of the opening balance and taxable income.
Step 6: Compute the adjusted taxable income after adjusting for inflows and outflows from the operating loss account.
Step 7: Multiply the adjusted taxable income by the statutory tax rate to determine the cash taxes.
Step 8: Subtract the book taxes from the cash taxes to determine the change in accumulated deferred taxes.
Step 9: Accumulate the deferred taxes through adding the changes in deferred taxes to the prior years balance. If the accumulated deferred taxes are positive, put the balance on the liability side of the balance sheet and if they are negative, change the sign and put the account on the asset side of the balance sheet.

Debt Schedules and Cash Flow Waterfalls

Introduction

While most time spent in financial modeling should be studying and analyzing value drivers, it is also important to accurately reflect financial structure so the value drivers can be translated into cash flow projections that will measures value and risk. Mechanical issues that translate key assumptions into effective analysis of the risk and value of debt and equity value discussed in the remainder of the chapter. This section describes various modeling issues that arise when incorporating debt into a corporate, project finance, acquisition or merger model. The amount of debt that can be issued and maintained on the balance sheet is central to the general idea of using the risk analysis process of lenders to derive value of an investment which is central to many of the ideas presented in this text. Furthermore, the risk to lenders in itself relative to the earned credit spread is also a critical subject in finance.

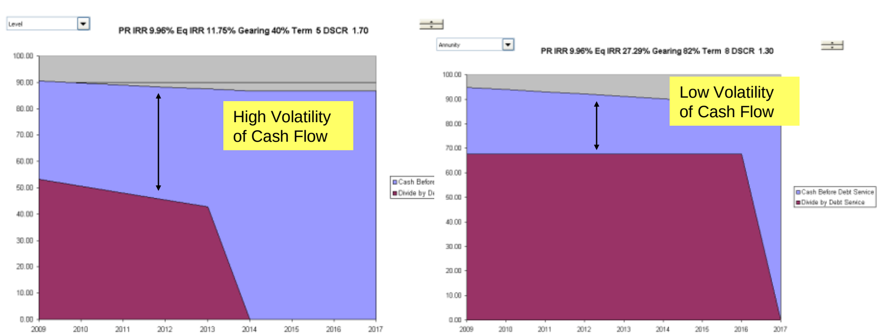
Once debt is incorporated into a model, the risk of the debt can be evaluated through constructing a cash flow waterfall. The cash flow to cover debt can be used to test how different levels of debt leverage affect break-even points of operating variables. Alternatively, the models can be used together with Monte Carlo simulation to compute the explicit probability of default and the required credit spread. The

mechanics of computing sensitivity analysis, break-even analysis, scenario analysis, tornado diagrams and Monte Carlo simulation analysis is described in the next chapter. The importance of risk analysis together with modeling debt comes together in determining debt capacity. If the cash flow that covers debt is accurately modeled, then one can see if cash flows in a downside case can cover debt. If cash flows cannot cover debt service in a downside case (perhaps with some margin) then the amount and the terms of the debt should change. Before describing the important financial issue regarding the manner in which volatility and judgment can be used in assessing debt capacity, the mechanics of computing various features of debt must addressed.

For each of the four types of models, analyzing details of the structure of the debt can be an essential component of the process of valuing cash received by equity and debt investors. One of the primary uses of corporate models is to assess the credit classification of debt while the project finance models and leveraged buyout models evaluate how specific risks affect the ability to repay debt. Risks of debt and risk classification of debt is crucial to the overall valuation process if one accepts the notion of using debt capacity to evaluate risk using the analysis of lenders whose job it is to evaluate risk, who are from outside of the organization and who have money at risk. Using a model to classify risk could be accomplished with Monte Carlo simulation as described in the next chapter. Alternatively, a more realistic approach is to compute the break-even points of different variables from the perspective of debt repayment. For example, in evaluating an electricity generating plant, one could compute how low the electricity price can fall before the debt defaults. If the electricity price can fall by a wide margin, the loan is less risky than if the electricity price can only fall slightly. Assuming the electricity price is the key item that is subject to uncertainty in the model, if one knew the probability of the electricity price falling below the break-even level, one would also know the probability of default.

Debt Capacity from Cash Flows with Different Volatility

- High Risk Cash Flows
- Low Risk Cash Flows



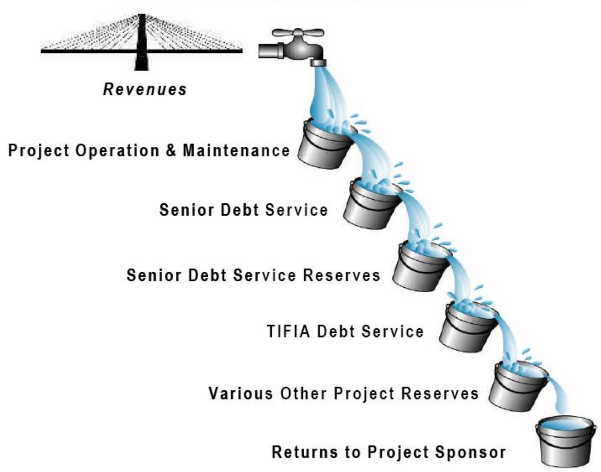
High Risk Project has higher margin, shorter-term and declining debt service. Low risk has flat debt service, and longer-term and higher IRR on Equity

Given the importance of evaluating risks faced by lenders, reflecting the specific features of debt in a model is an essential part of the modeling process. These features include the amount of debt, the repayment structure of the debt, fees paid and spreads on the debt, covenants and required debt service reserves can be principal determinants of whether the transaction will proceed. Depending on the transaction, the covenants and credit spreads may depend on financial ratios such as the debt service coverage or the debt to EBITDA. Similarly, the nature of debt issued in leveraged buyouts is a key driver of equity returns and the financial viability of the transaction. The structure of debt repayments, new debt issues and the credit spreads is also important in corporate models and merger integration models as the amount of debt issued in a merger can be an important driver of the accretion or dilution in earnings per share. Given the importance of debt in many types of transactions, this section describes various issues associated with structuring the debt schedule in the four model types.

Cash Flow Waterfall

Any time debt is issued to finance capital expenditures and other items of a corporation, the uses of funds in a project financing or the purchase of a company, a loan agreement defines various restrictions on uses of cash to pay dividends, subordinated debt and other items. The manner in which a loan agreement establishes priorities in the use of cash flow is sometimes called a cash flow waterfall. The term waterfall is used to represent the flow of cash. In some situations who gets the cash flow is carefully defined. This is somewhat analogous to the manner in which water is held in reservoirs and used allowed to flow to various sources is analogous to allowing cash to be used in a specific manner. A cash flow waterfall is illustrated in the diagram below. In corporate loan agreements, the definitions of cash flow priority are not as specific and detailed. For project finance models and acquisition models, modelling the mechanics of cashflow waterfalls that include cash flow sweeps, use and repayment of revolving credit, cash trap covenants, use and repayment of debt service reserve accounts, debt defaults and repayment of defaults as well as interest and repayment of subordinated debt can be intimidating to model, much less analyze in a clear and concise manner.

Exhibit 2-B: Example of Project Flow of Funds



In setting up a cash flow waterfall, you can apply a few ideas and make a seemingly complex waterfall easy to program in a financial model. The general ideas include setting up the debt schedule first, structuring the cash flow statement with a whole lot of subtotals second, evaluating whether cash flow is positive or negative using the MAX function third and assuring that you have not exceed defined limits of debt using the MIN statement relative to the opening balance. The specifics of the ideas include:

- First, set up the debt schedule and reserve balance schedule with opening balances, prepayments from sweeps, uses repayments and availability of revolving credit, required balances, uses and top-ups of debt service reserve accounts and the balance, debt defaults and repayment of defaults for the defaulted debt.
  - For each item such as cash flow sweeps, defaulted debt, repayment of defaulted debt that comes from the cash flow statement, leave the amount in the debt schedule blank. Amounts from the cash flow statement should all be linked to the debt schedule at the end of the process.

- Second, set up the cash flow account titles and the structure of the cash flow waterfall in the model without entering any formulas.
  - In setting up titles include a whole lot of subtotals in the model design – after virtually every element, such as borrowings and paying back the working capital facility, the debt service reserve flows, the debt defaults and repayment of defaults, the cash flow sweep, and the cash trapped by the covenant.
- Third, evaluate each step of the waterfall differently depending on whether the cash flow is positive or negative.
  - Use the MAX(cash flow,0) function to test for positive numbers and use the MAX(-cash flow,0) to test negative numbers. For example, if the cash flow after senior debt service is negative, then you should draw from the revolving credit account and use MAX(-number,0) while if it is positive you should use available cash to repay balances and apply the MAX(number,0) function.
- Fourth, in determining how much cash is available or must be used to pay back items, use the MIN function and test the amount against the opening balance.
  - Many of the calculations in the cash flow waterfall will include both a MIN and a MAX function, but this does hopefully does not mean that the formulas are too complex. For example, when modelling the amount of cash flow that is borrowed from the working capital account, the formula should look something like:
    - MIN(opening balance of available to borrow, MAX(-cash flow,0))
  - If cash flow is positive, then the second component of the formula is zero and the minimum of zero or the balance available will be zero. When the cash flow is positive, then the positive cash flow can be used to repay amounts in the working capital facility as shown in the formula below:
    - MIN(opening balance of revolving debt, MAX(cash flow,0))
  - In this formula, if the opening balance is paid off, then the formula will result in zero as it will if the cash flow is negative.
- Fifth, link accounts in the cash flow waterfall to the debt schedule.
  - In attaching accounts, the formulas in the debt schedule should be all be simple links, as the evaluations with MAX and MIN formulas have been made in the cash flow analysis. The rule is to keep the formulas in the debt schedule extremely simple.

Basic Debt Schedule

The fundamental part of any debt schedule is defining the balance of debt outstanding and computing the interest rate from the balance of the debt. The debt outstanding should be structured by explicitly showing the opening balance, the new debt issues, the debt repayments and the closing balance on separate rows of the model. These debt balance schedules should be listed for every single existing and prospective debt facility that will be present during the forecast horizon. For corporate models, the debt schedule should include all of the debt issues that are outstanding for the last balance sheet date plus any new issues that may occur over the forecast period. In the case of project finance models, the debt issues include all of the different tranches of debt that are issued to finance construction. In addition,

project finance models should be set up to include debt issues that will in a re-financing. Leveraged acquisition models should include debt issues that are used in financing the acquisition as well as debt that was issued prior to the acquisition and that will be assumed by the new owners. Similarly, the debt schedules of an integrated merger model include new debt issued in the transaction as well as debt that remains outstanding for both the target company and the acquiring company.

The starting point for the debt schedule differs depending on the type of model. When developing corporate models, the closing balance of each debt balance is launched from the financial inputs which should list the amount outstanding in the base balance sheet year for each debt issue. The sum of these individual issues should correspond to the total amount of long-term debt on the balance sheet (including current maturities of short term debt.) If the sum of the closing balance of all of the debt issues does not equal the balance sheet amount, the prospective balance sheet will not balance and there will be an inconsistency in debt maturities and interest expense with actual financial obligations. Therefore, a verification check to assure that the total debt on the balance sheet equals the sum of the individual debt issues can be effective in verifying the model. The process of adding a debt schedule to a corporate model is demonstrated in the following few steps:

- Set-up the debt schedule with separate lines for:
  - The opening balance
  - Additions from new issues
  - Subtractions from debt repayments
  - The closing balance
- The initial closing balance is derived from inputs that tie to the balance sheet
- The subsequent opening balance is equal to the closing balance in the prior period
- Once the opening and closing balance are computed the interest cost (whether capitalized or expensed) can be computed as a weighted average of the closing and opening balance. If the repayment occurs at the beginning of the period, the interest expense is computed on the closing balance. If the repayment occurs at the end of the period the interest expense is computed on the opening balance. If the repayment occurs somewhere between the beginning and end of the period, the interest is a weighted average of the opening and closing balance.

An example of a debt schedule in a corporate model is shown below. The quantification of interest expense on a fraction of year basis must be treated with care in a financial model. If the debt is re-financed or results in equity cash flow, this re-financing or equity cash flow must also be modeled on a partial year basis. In the case of project finance models, the new debt draw downs that define how much debt will be issued in a project are computed from the source and use statement and from some criteria that defines how re-financing will occur. Leveraged acquisition and integrated merger models combine information from the sources and uses analysis and the existing debt balance sheet to determine how much debt will be outstanding after the transaction.

The manner of repaying debt depends on the type of debt issue and the type of the model. In some models, the repayment calculation can be derived from the opening balance of the debt. For example, in a corporate model where debt issues may be repaid on a single date – bullet repayments – a simple test can be created from the repayment year and this is used to assure that repayment only occurs on the repayment date. Specifically the programming involves:

- Add a line for the repayment of the debt after the opening balance
- Create a formula that compares the model year with the repayment year to create a logical variable (year = repayment year)
- Multiply the (year = repayment year) by the opening balance of the debt

The manner of debt repayment in a project finance model or a leveraged finance model is often tailored to the expected cash flows generated by the investment. For example, a project finance model may have a pre-defined set of repayment percentages that vary over the lifetime of the debt. Because of the percentages are applied to the aggregate amount of debt issued rather than the closing or opening

balance it is generally a good idea to show the total accumulated amount of the debt on a separate line item above the debt balance. This accumulated balance can then be multiplied by the repayment percent or a tailored repayment schedule to establish the periodic repayments. Because of early debt repayments that can occur if covenants or cash sweeps are triggered, it is important to make sure that the amounts in the repayment row do not exceed the amount of debt outstanding. To program this, the MIN function should be used to assure that the amount being repaid does not exceed the opening balance of the debt. For leveraged acquisition models and/or integrated merger models, a combination of the corporate finance and the project finance approaches can be applied depending on the type of debt used to finance the acquisition.

Computation of Interest Expense with Credit Spread Grids

The credit spread can change over time and it can also depend on financial ratios. An example of a grid is shown below.

Spread No	3			1.5%-1.7% Spread		
			From Year	2008	2011	2015
			To Year	2011	2015	
DSCR	From	To				
	-	1.20		1.70%	1.90%	2.00%
	1.20	1.50		1.60%	1.70%	1.80%
	1.50	1.80		1.55%	1.65%	1.75%
	1.80	-		1.50%	1.60%	1.70%

In developing the interest rate, two technical issues arise, the first is finding the rate to apply and the second is working through circularity that can occur. Use the INDEX command with the MATCH command. As explained above use the “from column”. One can show the row number and the column number from the table using two MATCH statements – the row number matches the DSCR and the column number matches the year (you can group and hide the row and column number lines using the hide command – SHIFT then ALT then right arrow.) Then use the INDEX function with the row and the column. To get around circularity, use the previous year DSCR in the test. If use current or forward DSCR, then must resolve circularity which can create dangerous circularity in a model. Note: Also use the DAYS360 function if the model does not have annual periods – DAYS360/360 multiplied by the interest rate.

Defaults on Debt and IRR on Debt

In using a model to assess an investment with debt financing, one of the essential tasks is to determine at what point a loss on the loan occurs. When a loss on debt occurs, the interest rate or the IRR realized by lenders is less than promised interest rate and attempts to restructure the debt have not allowed temporary defaults to be repaid. The IRR earned on debt can be computed by measuring the cash flow dispersed to lenders and then the debt service received by lenders. Modeling defaults on debt is useful in credit analysis because the ultimate task in credit analysis is to measure the probability of default as well as the loss given default relative to the credit spread that compensates for risk. Through explicitly modeling defaults, one can analyze at what point the cash flow is insufficient to repay the debt after restructuring. Once the realized IRR on debt is computed through accounting for defaults, the risk of debt can be evaluated through break-even analysis, scenario analysis and Monte Carlo simulation. For example, by incorporating defaults on debt in a model, the break-even level of EBITDA can be computed. The probability of achieving this break-even level of EBITDA can then be used to assess the credit spread of the loan.

The process of incorporating defaults into a financial model involves linking the cash flow statement with the debt schedule. The amount of defaults is determined after the cash flow is computed and this amount affects the debt balance that is outstanding. The following process can works through how to compute the defaults:

Step1: Set up the a debt balance schedule for the defaulted debt with line items that include the opening balance of defaulted debt, the additions to the defaulted balance from defaults, the repayments of default from positive cash flow and the ending balance of defaulted debt.

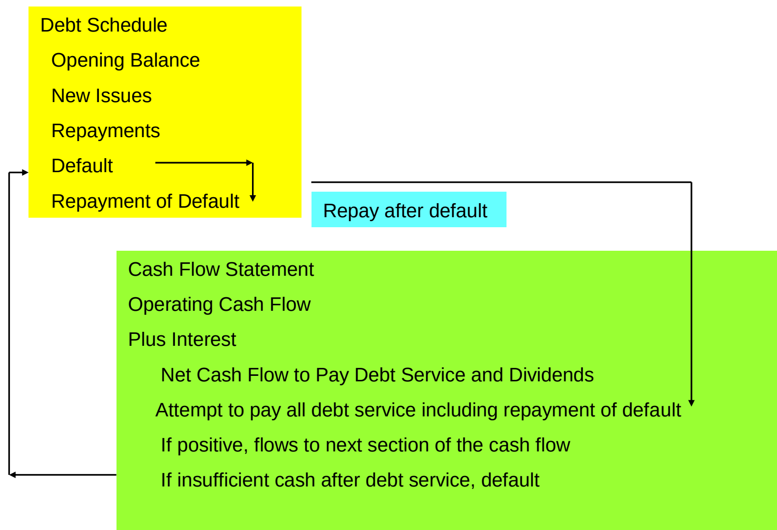
Step 2: Fill in the default row from a sub-total line in the cash flow waterfall that computes the default on debt from the inability to meet debt service (this should be computed using the formula MAX(-cash flow,0) on the cash flow statement. In the debt schedule, the line items that depend on cash flow should be linked to the cash flow statement.

Step 3: In the cash flow statement, set-up as line for the re-payment of default. The repayment of default is a function of the cash flow and the amount of debt default. It is the minimum of the positive cash flow or the opening balance of the defaulted debt. Once the repayment of the default is computed in the cash flow waterfall using the formula above, link the repayment of default to the debt schedule.

MIN(opening balance of defaulted debt, MAX(cash flow,0))

Step 4: Compute the cash flow realized by lenders through deducting defaults and adding re-payment of defaults to the scheduled debt service.

A diagram that is intended to illustrate the link between the cash flow statement and the debt balance is presented below. The diagram below illustrates that the default comes from the cash flow statement, the repayment of default comes from the earlier default, and the repayment of default is put back into the cash flow statement.



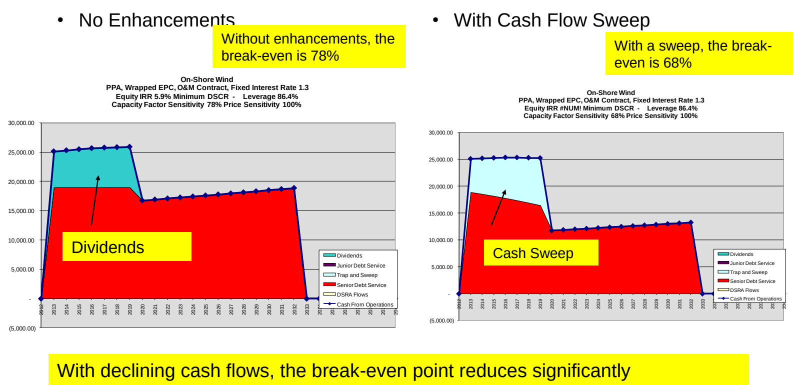
Covenants and Sweeps

In negotiating with lenders, one of the subjects that must be analyzed is the level of covenants and cash flow sweeps. Covenants can range from mandating that equipment is in good working order to strict limitations on payment of dividends. For modeling purposes, it is the latter type of negative financial covenants that should be incorporated in a model. These covenants can affect returns to equity investors because they affect the timing of cash flows that are allowable to be paid out as dividends. The covenants can take the form of cash flow traps that limit dividends when times are bad (and there is not much cash flow available for dividends anyway.) Alternatively, the covenants can be in the form of cash flow sweeps which limit the cash flow that limits the cash than that can be distributed when times are good.

Covenants do not change the operating cash flow of an investment and can only change the timing of who receives the money and in what order. With more restrictive covenants, the equity holders must wait while without the covenants, the equity holders can receive cash flows earlier. The timing of equity cash flows can have relatively large effects on the equity IRR and assuring that cash flows accrue to lenders before equity holders can reduce the risk to holders of debt.

A financial model should be able to assess the tradeoff between risk and return of covenants and cash sweeps. For example, the model can be used to assess how much the operating income can decrease with and without a covenant to evaluate the effectiveness of the covenant. If the covenant allows the operating to decline by a wide margin more than the operating income can decline without the covenant, than the covenant is effective in reducing risk. The efficacy of the covenant depends on the structure of the cash flow. If cash flow is increasing over time, the covenant will not be effective in reducing risk. If the cash flow "falls off a cliff" after a few years, the sweep and covenants can be effective. A summary of the analysis of covenants and sweeps is illustrated below.

Effect of Cash Sweep With Declining Cash Flows



The mechanics of modeling covenants are analogous to calculating defaults as described above. In particular, the debt schedule is tied to the cash flow statement. In the case of covenants, the cash that is not allowed to be paid in dividends can be either used to pay of debt earlier than scheduled or alternatively, it can be placed in a cash reserve account depending on the language of loan agreements. If cash is used to pre-pay debt, the cash that is trapped should be included in a line item in the debt schedule. If the cash is applied to a reserve account, a separate account should be set-up the debt module of the model. The step by step process below describes how to incorporate a cash trap or a cash sweep covenant into a model.

Step 1: In the cash flow statement, add sub-total rows that show the cash flow that is available for a cash sweep or a cash covenant.

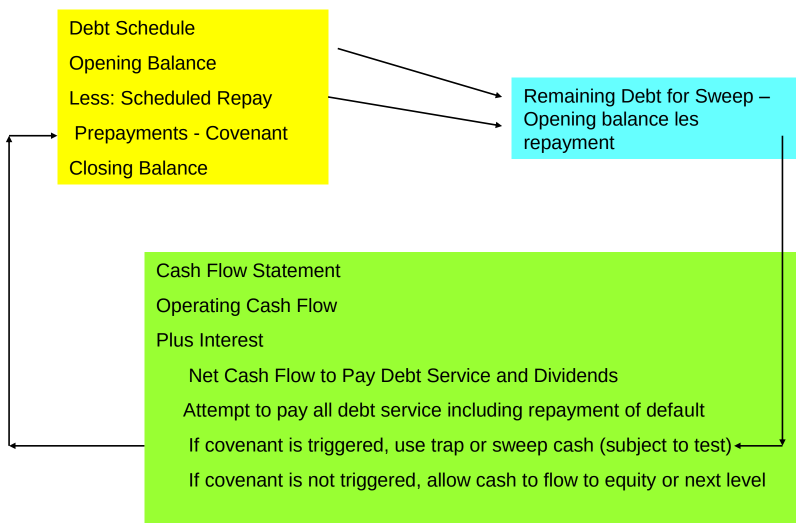
Step 2: Include a test in the model that evaluates how much of the cash that is available for the cash sweep or cash trap will be unavailable to pay dividends or other subordinated debt. This may be a test against the debt service coverage ratio in the case of a cash trap covenant or a test against a debt to EBITDA ratio in the case of a cash sweep covenant in a leveraged buyout.

Step 3: Use a covenant test to determine the amount of cash trapped or swept in the cash flow statement. The test could be whether the DSCR is below the covenant in the case of a cash trap, or it could be a multiplication of a cash sweep percentage.

Step 4: In the cash flow statement where a line item lists the cash flow sweep or cash flow trapped, the line item should include a minimum function to assure the most cash that is trapped is the amount of debt outstanding.

Step 5: The cash flow that is trapped or swept must be applied to something. One option is to use the cash to pre-pay debt and the second is to build-up cash in a reserve fund. If cash is used to pay down debt, then as long as the minimum function is used in the repayment analysis, then the debt will appropriately be paid earlier. If the reserve account is used, then an item must be added that releases cash from the reserve when the covenant is met or the debt is repaid.

The diagram below illustrates how process for covenants or cash flow sweeps works in terms of linking the cash flow statement to the debt schedule. (Note that if the cash flow from the cash sweep or the cash trap is applied to a reserve account, the proceeds are used as cash inflows into the cash reserve.) The intermediate box in the diagram demonstrates that evaluation must be included somewhere in the model to assure that the cash flow sweeps are not pre-paying more debt than is outstanding – if all of the debt is paid, there is no longer a reason to sweep any cash. If a cash sweep or a covenant is implemented, then the cash that is prevented from paying dividends can either be used to pre-pay debt or put into a reserve account. For debt holders, prepaying debt is more favorable from a credit perspective because it permanently reduces debt while money in a reserve account can be used to pay dividends before debt is repaid. Mechanically, the programming of sweeps and covenants is similar to modeling of defaults in terms of connecting the debt schedule to the cash flow statement. Structuring provisions on debt such as cash lock-ups and sweeps limit distributions to equity in different ways. Discussion of the reason for covenants and sweeps in alternative transactions. How much they really protect the debt holder and harm the debt holder. The effect in alternative transactions – project finance and leveraged buyouts. Modeling issues.



As with the discussion above, to avoid circularity, use the prior year debt service coverage ratio. When developing the model use the prior. If the terms require forward DSCR or current DSCR, then compute a fixed line and use a circularity resolution method.

Subordinated Debt

The most basic issue in finance is assessing risks and returns from an investment. This issue is highlighted in analysis of subordinated debt where the higher credit spread on subordinated debt must be evaluated relative to the higher risk of subordinated debt relative to senior debt. To evaluate the risk of subordinated debt, a financial model much be able to determine the point at which the loss occurs and the risk and return characteristics of the subordinated debt. In modeling subordinated debt, the first step is to include the debt in the sources and uses analysis. Using the sources and uses analysis, the subordinated debt should be added to the debt schedule. When developing the debt schedule, it is

possible that interest is capitalized. To model the interest capitalized, the interest is added to the balance of the debt. In the final period when the subordinated debt matures, the amount of the debt repayment is the sum of the opening debt balance and the interest capitalized for the final year.

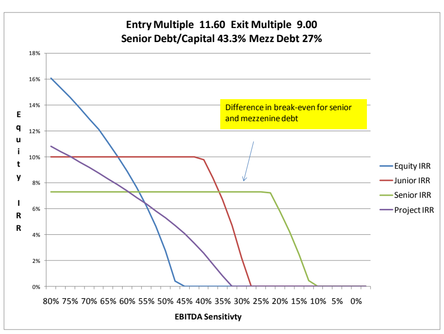
Once the debt schedule is established for subordinated debt, the cash flow statement must reflect the priority of the subordinated debt relative to other debt service. If debt with differing priority is included in the cash flow statement, then a cash flow waterfall should be modeled that reflects the specific provisions including the interest, repayment of debt service, covenants and sweeps of the alternative debt. When structuring the cash flow statement with alternative priorities, it is essential that the ordering of titles in the cash flow analysis conform the ordering of cash flows in the loan documents. For example, if there is a cash flow sweep for senior debt and junior debt interest is not capitalized, then the senior debt sweep must occur after the junior debt interest payments. An example of how junior debt is incorporated in a cash flow waterfall is illustrated below. Notice that there are many sub-total lines.

Cash Flow							
EBITDA & Terminal	-	950.00	1,100.00	1,300.00	1,500.00	1,600.00	14,688.00
Less: Senior Interest	-	201.60	168.00	130.45	76.27	4.30	-
Less: Repayment of Senior	-	480.00	480.00	480.00	480.00	61.40	-
Cash after Debt	-	268.40	452.00	689.55	943.73	1,534.30	14,688.00
Add: Defaults on Debt	-	-	-	-	-	-	-
Cash After Default	-	268.40	452.00	689.55	943.73	1,534.30	14,688.00
Less: Repayment of Default		-	-	-	-	-	-
Cash After Default Repayment	-	268.40	452.00	689.55	943.73	1,534.30	14,688.00
Less: Interest Paid on Junior	-	384.00	395.56	395.56	395.56	395.56	281.69
Cash After Interest on Junior	-	(115.60)	56.44	293.99	548.17	1,138.74	14,406.31
Add: Default on Junior Interest	-	115.60	-	-	-	-	-
Cash Flow for Sweep	-	-	56.44	293.99	548.17	1,138.74	14,406.31
Less: Senior Cash Sweep	-	-	56.44	293.99	548.17	-	-
Less: Junior Repayment	-	-	-	-	-	-	2,816.86
Cash after Junior Repayment	-	-	-	-	-	1,138.74	11,589.46
Add: Default on Junior Debt	-	-	-	-	-	-	-
Less: Junior Sweep		-	-	-	-	1,138.74	-
Equity Cash Flow - Dividends	-	-	-	-	-	-	11,589.46
Cash Flow Test	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE

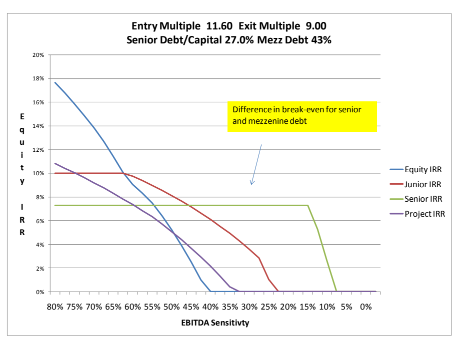
To illustrate how a model can be used to assess the risk of senior versus subordinated debt, a sensitivity analysis can be performed of the EBITDA in terms of senior IRR, subordinated IRR, equity IRR and the overall project IRR. The difference in points at which the senior IRR and the junior IRR crosses is a measure of the risk. In the diagram below the case with more subordinated debt has more risk as demonstrated by the break-even points.

IRR on Senior versus Junior Debt with Different Capital Structures

- More Senior Debt



- More Subordinated Debt



Debt Service Reserve Accounts (Project Finance Models)

Project finance transactions and some leveraged buyout transactions include requirements to put cash aside in a bank account to assure that prospective debt service requirements can be made. A typical requirement is that the next semi-annual debt service must be held in an account. Such an account assures that temporary blips in cash flow will not cause a default and assure that if something bad happens and the debt needs to be restructured, that time is available for restructuring. The problem with locking up cash in this manner is that holding cash on the balance sheet and earning a return much lower than the overall equity return can be very expensive in terms of the rate of return on equity.

Debt service reserves can present tricky modeling issues from a technical standpoint because the debt service is computed on a prospective basis. Since the debt service reserve cash flows depend on the next period cash flow and the next period cash flow depends on debt service, a difficult circularity problem arises. Other mechanical issues include: (1) computing changes in the debt service reserve account that arise from changes in debt service; (2) calculating uses of the debt service reserve account when there is deficit cash flow; (3) building-up the debt service reserve account from cash flow in a project; (4) withdrawing amounts from the debt service reserve account when debt matures; (5) adding amounts to the debt service reserve that arise from a cash flow sweep; and (6) transferring amounts from reserve built up during the construction period.

The fundamental manner to resolve this difficult issue is to compute a fixed level of debt service requirements after debt sizing routines have been developed. As part of the debt sizing routine (which is normally a macro) a routine that resolves circularity associated with the debt service reserve account should be included. If resolution of the circularity is included in the debt sizing routine, then the routine only has to run when the debt is sized and not when scenario and sensitivity analysis is performed. For example, the following steps can be used:

1. Develop a macro that computes sets the closing balance of debt to zero using a debt sculpting formula. The macro simply incorporates a goal seek routine that sizes the debt by setting the closing balance to zero.

2. Once the sculpted debt repayments have been computed, copy and paste the computed amounts to another line (copy and paste special). It is important to compute the fixed amounts because you do not want to re-compute the sculpted debt repayments when performing sensitivity or scenario analysis.

3. Use the fixed debt service rather than the computed debt service in the debt service reserve analysis. This will avoid the circularity associated with the debt service reserve account where the amount of funds required in the debt service reserve account depend on the next period debt service, but the next period debt service depends on the debt service reserve account.

4. After computing the debt service reserve account, the cash flow will change and the fixed debt service will no longer produce a zero balance in the ending debt account or the target debt service coverage ratio will no longer equal the realized debt service ratio. In addition, the fixed debt service will no longer equal the computed debt service. To resolve this problem create an iteration routine where goal seek in step 1 and the copy and paste in step 2 are repeated until the difference between the fixed and computed debt service is zero.

In general, a debt service account should be modeled in an analogous manner to debt issues with an opening balance, additions and subtractions, a closing balance and interest income (instead of interest expense). A technique that simplifies modeling of debt service reserves is to first establish the required amount that should be in the debt service reserve. Since the DSRA balance should equal the required balance, the net inflows to the account (a negative amount on the cash flow statement) can be established where by the inflows are the opening balance less the required balance. Computing the net amount in this manner is a short-cut method and one could separately show the various components

including removal of the closing balance and initial funding amounts. As with the discussion of cash flow sweeps discussed above, the amount of withdrawn from the debt service reserve or added to the debt service reserve comes from the cash flow waterfall. Steps to compute the debt service reserve account are described below:

Step 1: Compute the amount of the required debt service reserve from the next period fixed debt service as described above.
Step 2: Set-up the balance of the debt service reserve by including a line item for net inflows into the account to derive the required balance and a line item to withdraw from the debt service reserve account to meet cash flow short-falls.
Step 3: The difference between the required debt service reserve account and the opening balance of the debt service reserve account is the amount that must be funded or that is available for cash flow. This amount is the basis for evaluating whether funding is available. The potential for funding the DSRA depends on the amount of cash flow.
Step 4: In the sources and uses statement, include the amount required to be funded in the DSRA by multiplying the required funding by the construction phase switch. Do not use the amount of funding from the cash flow statement in the sources and uses statement – this will create a circular reference.
Step 5: Include a line item in the cash flow statement for net inflows into debt service reserve (note that this amount can be negative when amounts are withdrawn because the required balance declines and/or falls to zero at the end of the debt life.) Compute a sub-total line in the cash flow statement as the cash flow before debt service reserve account flows. If this amount is positive, then the DSRA can be funded (or amounts can be withdrawn) up to the amount that is required as illustrated below:

MIN(MAX(cash flow for DSRA,0), Required DSRA Funding)

Step 6: Include a subtotal line after the payment of debt service to reflect the potential for negative cash flows that arise. Once the negative cash flows are computed, evaluate whether the amount can be met from the reserve balance. The formula is shown below:

MIN(opening balance of DSRA, MAX(-cash flow,0))

Circularity Created by Interest Expense (Corporate Models)

In many models, a problem of circularity arises because interest expense drives cash flow, but the debt balance or the interest expense is affected by cash flow itself. The most common circularity problem in corporate models comes from the assumption that cash flows and therefore interest expenses occur in the middle of the year. (If monthly or even a daily model is constructed, the circularity would not arise because interest is paid on the opening balance of the debt.) If the assumption of interest expense on the opening balance cannot be applied, then the interest expense affects cash flow, but the cash flow affects the debt balance and interest expense, the interest expense requires iterative calculations. In the real world, bankers do not require interest expense to be paid using a circular formula where they first compute interest expense and then re-compute the interest expense because the debt is increased by interest expense. The problem with circular calculations is that the iterative calculations can cause models to be unstable. There are various ways to resolve the circular references, but the solutions can be worse than the original problem. The problems can be resolved with macros or the solver function.

The simplest and most common method involves creating a macro using the following steps:

Step 1: Make sure there are two calculations of the thing that is causing the circularity (e.g. interest expense computed in the profit and loss statement and interest expense calculated in the debt schedule).

Step 2: Compute the year by year difference between the two calculations and then sum all of the differences.

Step 3: Record a macro and then copy and paste special as values from one of the rows to the other. For example, in the case of interest expense, copy the interest expense line below the debt schedule and paste it special to the income statement.

Step 4: Modify the macro to include a while and end loop that continues until that sum of the differences equals zero as illustrated below.

While Range(“sum_of_difference”) <> 0

Copy and paste special interest expense from debt schedule to profit and loss statement

Wend

Circularity and Debt Commitments in a Project Finance Model

Totally unclear

The general idea of establishing the size of debt and the debt capacity is an important issue in risk analysis and cost of capital (chapter 4). In determining the amount of debt that can be supported by a company or a project, one cannot generally boil the analysis down to a simple formula such as setting the debt service coverage ratio to 1.6 in order to obtain a BBB bond rating. Once the process of setting some financial ratio to a benchmark level has been established, the mechanical process depends on how the level of debt is computed in a model. A simple approach is to compute the debt level from a given leverage ratio through multiplying the total uses of funds by the ratio. This method can lead to circularity problems because the amount of the fees and the interest during construction drive the uses of funds. This method does not conform to reality and it does not allow computation of items such as commitment fees, up-front fees and required funding of cost over-runs.

Important to set-up the model in a structured fashion.

Need macro to compute the debt size anyway. Discuss philosophy – it would be much better to not have any macros in the sheet. But if you must, then at least sensitivity analysis should be allowed. Shove everything into the loop

Step 1: Compute debt amount

Could be from input commitment, from target DSCR or from sculpting
Put goal seek in macro

Step 2: Compute re-payment using flexible option
Could be level, mortgage style or sculpting.

Step 3: Fix the debt level
Run copy and paste macro
Show a diagram of the process
Should have formula and then fix the debt
Can fix the debt at the end of the macro
What should be included in the circularity loop
Need to answer – does the DSRA loop affect other things

Step 4: Use fixed debt level in DSRA Calculation

Hints for effective design of macro.
Importance of model verification.

Establish bank case and margin. A better approach which reflects the manner in which debt is really issued is to define the debt commitment as an input and also define the manner in which debt the debt is drawn on a periodic basis. For example, the debt commitment may be 1,000 and the percentage drawn may correspond to the percent of the total construction that is spent in each period.

When a company goes to a bank to ask for a loan in a project financing, the company has already created a model and evaluated the sizing of debt, presumably through evaluating the debt service coverage or some other criteria. Some suggest from a philosophical standpoint that circularity is not a logical notion. The sponsor does not go to the bank and ask for fees and then ask for another loan as the fee changes and then, when the fee changes again, ask for yet another loan. Instead, the sponsor asks for a loan commitment that will define the fees, the debt service reserve account, and the interest during construction that can cause a circular reference problem.

There are alternative methods to compute the debt commitment, most of which require some form of goal seek and/or a macro as described below. Alternative approaches include:

- Multiplying the total uses of funds in each period (included capitalized interest) by a given leverage ratio. The problem with this approach is that creates difficult to resolve circular references for fees, debt service reserves and interest during construction.
- Using a pre-determined leverage ratio to determine debt commitment. Here, the given leverage is multiplied by the total uses of funds in each period. Then, the amount of the commitment that matches the given debt leverage is derived from an optimization technique (a simple goal seek). For example if the total uses of funds are 100 in each of the first three periods and the leverage is 50%, then the goal seek would compute the total debt commitment required at the commercial operation date to achieve the leverage ratio. This could be accomplished by fixing the commitment and then computing the difference between the commitment and the computed required leverage until the difference goes to zero:
    - Debt draws = leverage x uses of funds – interested capitalized
    - Debt leverage at commercial operation = Total debt/(debt + equity)
    - Total debt – commitment = difference
    - Iterate until difference is zero
- Using a debt service ratio to compute the commitment. Here, the commitment is spread across the construction period according to a ratio.

Debt Sizing and Debt Sculpting

If the debt commitment is an input to the model, then the amount of the commitment can be computed using the goal seek of the solver. Here, one pre-determines the level of the debt service coverage, the leverage or some other parameter and then backs into the amount of the debt commitment that will make the computed debt service coverage ratio equal the target amount. For example, if the target minimum debt service coverage to obtain a BBB rating is 1.4 in the base case, then the computed minimum debt service coverage ratio is set to 1.4, which is directly input into the goal seek process, by changing the debt commitment which is input. Alternatively, the debt can be sized by evaluating cash flows in the downside case, in which case the target debt service coverage would be lower.

The goal seek process in excel has a number of problems, including the fact that the inputs are not retained for re-use and the fact that the target must be input as a number and cannot be extracted from an excel reference. A very simple macro can resolve these problems. This involves the following steps:

- Enter the target debt service coverage in a cell in the workbook;

- Turn on the record macro button and then use the goal seek process to set the debt service coverage ratio by changing the debt commitment;

- Modify the recorded macro through using the macro edit button or the ALT, F11 combination of keys;

- When editing the macro, you will see code that defines the goal seek process. To edit the macro, replace the fixed number with the cell reference as illustrated below, where the target debt service coverage ratio is in cell F20;

  Before: Range("F14").GoalSeek Goal:=1.5, ChangingCell:=Range("F4")

  After: Range("F14").GoalSeek Goal:=Range(“F20”), ChangingCell:=Range("F4")

- Replace the cell references with range names in the macro (a practice that should always occur because otherwise the macro will not work when you insert or delete rows);

  Range("C_DSCR").GoalSeek Goal:=Range(“Target”), ChangingCell:=Range("Debt")

- Create a spinner box that is linked to the target debt service coverage ratio (you will have use the cell link to an open cell and then divide the cell by 100).

- Attach the macro to the spinner box, through right clicking on the spinner box.

When working on a project finance model, you sometimes would like to compute the debt capacity through “sculpting” the debt repayments such that the debt service coverage ratio achieves a targeted ratio in each period. This is accomplished using the solver and the following steps:

- Setting the both debt leverage and the repayment for each period.

- Add a constraint that the computed debt service ratio equals the target debt service coverage ratio

- Add a constraint that the final debt balance must be zero.

It is helpful to set-up a macro to re-do the solver with a macro. Unfortunately, this is a bit complex because the visual basic must be adjusted to allow the solver to work. This process involves:

- Step 1: Press the Alt-F11 key to get the visual basic menu
- Step 2: Go to the TOOLS, REFERENCE option and then click on the SOLVER option.
- Step 3: After beginning to record a macro, re-set the solver
- Step 4: Make sure the first part of the solver is not blank
- Step 4: Re-do the solver
- Step 5: Add a Userfinish = FALSE after the SolverSolve

An example of the solver code with the adjusted finish is illustrated below. All of the lines of code except the last line come from simply recording the macro after running the solver.

```
SolverReset
```

```
SolverOk SetCell:="$I$5", MaxMinVal:=3, ValueOf:="0", ByChange:="$G$32,$G$46"
SolverAdd CellRef:="$L$2", Relation:=2, FormulaText:="0"
SolverSolve UserFinish = False
```

While solver seems to be a very nice tool, it can be very slow and sometimes it does not work very well. A more elegant solution is to compute the debt repayments using a formula and then size the debt with the more simple goal seek. This is illustrated using a bit of simple algebra as illustrated below:

DSCR = Cash Flow/(Interest + Repayment)

(Repayment + Interest) x DSCR = Cash Flow

Repayment = Cash Flow/DSCR - Interest

The problem with this formula is that although the repayment yields the appropriate DSCR, the size of the debt does not mean that the ending balance of debt becomes zero. To deal with the problem of non-zero debt ending debt, a goal seek formula can be used to determine the leverage percent or the debt commitment. Of course then, it is a good idea to add a macro to the goal seek so that any time you change an input into the model you can re-size the debt. The only problem with the macro is that the ending debt cell may vary depending on the term of the debt (in many modeling problems, once you open one door to fix a problem, another door appears.) To fix this problem, you can use the SUMPRODUCT function along with a test for the term of the debt as illustrated below:

SUMPRODUCT(Closing debt balance series x (period = term of debt))

The result of this sumproduct function can then be used in the goal seek with the macro to establish the debt level that works with the sculpting.

Valuation from Financial Models

Appendix 3:
Real Estate Modelling Issues

Real Estate models are closely related to project finance models with a couple of exceptions that tend to make the models more complex. This appendix assumes that you have reviewed the sections that address project finance models related to setting-up project phases and time periods and describes some features of a real estate model that are different from a project finance model. Differences in a real estate model include:

- In modelling a single project such as a multi-family development or a hotel, the sale of a project after a given holding period is often modeled and the features of debt are different from typical project finance models.

- In modelling some projects, cash flow can be generated before construction on the project is completed which adds complexity to the sources and uses analysis.

- In modelling real estate projects, there are often multiple different units and buildings which are completed at different times meaning that there is not a single construction phase.

- In modelling commercial real estate investments, the analysis should include the effects of different lease terms

- Some real estate projects have multiple participating tranches with different return targets and sharing mechanisms

Modelling a Single Project

An effect way to understand a real estate project is first to model a single project and then later to put projects together in a portfolio described below in the section on mixed development. Modelling a single project is very similar to modeling project finance with the exception that a holding period is defined after which the project is sold. Operating inputs that drive the value of the project include the occupancy rate that varies with the life of the project, the rental rates which can be volatile, occupancy rates that are correlated with the rental rates and fixed and variable operating expenses. In selling the project a time period switch can be established for the terminal period. To define the sale price, a capitalization rate is generally used. The capitalization rate is the value of similar projects that are bought and sold in a market divided by the pre-tax cash flows. For example if a project is sold for 10,000 and its rental revenues net of operating expenses are 500, the capitalization rate is 500 divided by 10,000 or 5%.

Rather than using the total project life to measure the operating period as in other project finance models, the operating period is generally defined by the holding period before which the project is sold. Then, similar to the acquisition model described above, the project is sold after the holding period. This can be accomplished through dividing the cash flow by the cap rate which is a percentage and also by a terminal value switch (the terminal value switch is simply a TRUE/FALSE logical variable that is defined with the formula = (period = holding period). The theory behind the cap rate is very similar to the ideas underlying computing the terminal value using the final year cash flow divided by the cost of capital minus the growth rate. The cap rate reflects both the cost of capital and growth rate. For example if one believes the growth rate in rents is 2.5% in a market and the cap rate is 5%, then the implied cost of capital is 7.5% (cap rate = (WACC – g) which means that WACC = cap rate + g). With a higher growth rate the cap rate should be lower and if the cash flows are less risky (for example, if there are fixed leases) then the cap rate is also lower.

Once the proceeds from selling an asset are computed (net of fees and other transaction costs) a couple of accounting and tax issues arise. For tax purposes a capital gain is generally computed as the sales proceeds less the net book value of the fixed assets. The capital gain is the sales proceeds less the Once the rate of return in a real estate model is computed – the equity and project return Real estate debt can take many forms as with project finance debt, but when the project is sold at the end of the holding period, the debt must be retired. In addition, when the project is sold, the fees and taxes on the gain on sale should be accounted for.

Cash Flow Generated Before Completion of Construction

In some real estate projects, projects are held for trading rather than investments. In these cases, cash flow is generated from receiving progress payments before construction is complete. This cash generated from selling a project reduces the need for additional debt. Further if the proceeds are more than the total amount of debt required, the cash is deposited into a reserve account. If there is money in this cash reserve account and future financing needs occur, then the reserve account is used for future cash needs. This cash process can be modeled in a similar way as the cash process that was described in a standard corporate model where deficit cash flow is funded by raising new debt and surplus cash goes to retiring cash and/or reducing debt.

Modelling a portfolio of different projects

In modeling a portfolio of projects, you would like to be able to change the occupancy dates, the construction dates and the S-curves of different parts of a portfolio. When programming different projects, reflecting different time periods can be accomplished by using the following general ideas:

First, establish a start date for the model. This start date is used to record the dates that are common to each of the projects in the model. If each column of the spreadsheet has the same date, then one can eventually add up all of the separate projects to obtain the aggregate cash flow for the calendar period. In the project finance models discussed above, the start date of the model and the start date of the construction (or development) are the same.

Second, develop a template model that can be used to compute the operating cash flow for each project. To make a template that works for each individual project, you can use the INDEX function along with a code number for each individual part of the portfolio. In the simple example presented below, the index command would be used to define the cost, the sale price, the construction profile and the period finished for the three components of the project. A single cash flow model would be set-up that uses the different cost, sales price and other inputs. If the inputs are set-up in a structured manner with items such as the completion date, the cost, the lease rate, the capitalization rate, the utilization rate and other factors, the amounts can be extracted for each separate project. In addition to the input data for individual projects, general assumptions should be made for factors such as the general inflation rate.

Assumptions								
				Sales	Constr	Period		
		Code	Cost	Price	Profile	Finished		
Residential Type 1		1	1,000.00	1,500.00	3	1-Jan-12		
Residential Type 2		2	2,000.00	2,500.00	2	1-Jan-15		
Commecial		3	3,000.00	3,200.00	1	1-Jan-15		
Period		-5	-4	-3	-2	-1	0	Total
Profile 1	1	0%	0%	0%	25%	50%	25%	100%
Profile 2	2	0%	0%	0%	0%	50%	50%	100%
Profile 3	3	30%	25%	20%	10%	10%	5%	100%

Third, after the common start date is established, compute the period code. This is done through comparing the commercial operation date (called the temporary occupancy date in real estate) and the common start date. Using the inputs in the above example, the period code would be different for the first and the second project – it would be a larger negative number for the project with the further out date. This is analogous to computing the construction periods discussed above for the project finance model. Recall that if a periodic model is used, the DAYS360 function can be applied. (If the days in a 360 day are known and the model is computed on a monthly basis, then the DAYS360 command should be divided by 30.)

To see how this process works, assume that the common start date is 2012 and that there are two operating components. The first has a start date in 2014 and a two year construction period and the second has a start date of 2015. Both have a cost of 1,000 and a two year construction period. In this case the first period for the initial project is -1 and the first period for the second project is -2. The construction period is -1 and 0 for both projects. Since -1 is in the first year for the first project and it is the second year for the second project, the construction expenditures are arrayed differently. The manner in which the model for individual components can be set up is illustrated below. In the table below, the period code is used to define the S-curve table that defines construction expenditures as a function of the period code. The S-curve can is established by using an HLOOKUP table.

First Project													
Number	1												
Residential Type 1													
Commercial Date	1-Jan-12												
Periods Prior to Operation	5												
First Period	-4												
Profile Index+1	3												
Cost	1,000.00												
Price	1,500.00												
Period Code		-4	-3	-2	-1	0	1	2	3	4	5	6	7
Construction Profile		0.25	0.2	0.1	0.1	0.05	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Construction Profile		0.25	0.2	0.1	0.1	0.05	0	0	0	0	0	0	0
Cost		1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00
Construction		250.00	200.00	100.00	100.00	50.00	-	-	-	-	-	-	-
Cash Proceeds from Sales Price		-	-	-	-	-	1,500.00	-	-	-	-	-	-
Revenue Recognized - Pct of Completion		375.00	300.00	150.00	150.00	75.00	-	-	-	-	-	-	-

Once the individual cash flow model is established, the amounts from the individual parts should be aggregated in creating a financial model. The aggregation can be accomplished by using the data TABLE function. The code for the individual project is the column sensitivity in the data table and the column input is the number used in defining the INDEX function. In the above example, the column input is the cell reference for the number 1. Simply add the cash flows for different projects using a date code that begins with the overall model start date that was used to compute the period code for each project. The manner in which the data table can be used to aggregate cash flows from individual projects is illustrated in the table below.

Cash Flow Analysis											
Total Proceeds from Sales											
Residential Type 1	-	-	-	-	-	1,500.00	-	-	-	-	-
1 Residential Type 1	-	-	-	-	-	1,500.00	-	-	-	-	-
2 Residential Type 2	-	-	-	-	-	-	-	2,500.00	-	-	-
3 Commercial	-	-	-	-	-	-	-	-	-	-	3,200.00
Construction Expenditures											
Residential Type 1	-	-	250.00	500.00	250.00	-	-	-	-	-	-
1 Residential Type 1	-	-	250.00	500.00	250.00	-	-	-	-	-	-
2 Residential Type 2	-	-	-	-	500.00	1,000.00	500.00	-	-	-	-
3 Commecial	-	-	-	-	-	-	-	750.00	1,500.00	750.00	-
Net Cash Flow											
1 Residential Type 1		-	(250.00)	(500.00)	(250.00)	1,500.00	-	-	-	-	-
2 Residential Type 2		-	-	-	(500.00)	(1,000.00)	(500.00)	2,500.00	-	-	-
3 Commecial		-	-	-	-	-	-	(750.00)	(1,500.00)	(750.00)	3,200.00

Once the cash flows are aggregated, the financial model can be developed. Since there are multiple parts with different construction and cash flows, the model should not necessarily begin with a sources and uses statement. Instead, a working capital facility and a debt facility can be developed for situations when the cash flow is negative. Similarly, a routine can be developed to issue equity before or after the issuance of debt. Methods to develop the debt schedule and a cash flow statement with a waterfall involving structuring the cash flow statement and using the MIN and MAX functions is described above.